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A study of the relationship of tensile strength between single and ply yarns from all-cotton and all-nylon fibers.

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A STUDY OF THE RELATIONSHIP OF TENSILE STRENGTH BETWEEN SINGLE AND PLY YARNS MADE FROM ALL-COTTON AND ALL-NYLON FIBERS

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TABLE OF CONTENTS

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LIST OF TABLES

Table Page

Table | Page

LIST OF FIGURES

Figure Page

SUMMARY

Two fibers were selected for this study. Cotton fibers in the form of roving were spun into a single yarn with varying twist multiples from 2.50 to 6.00. Nylon staple fibers in the form of roving were spun into a single yarn with varying twist multiples from 2.50 to 5.50. The count of the single yarn for both the cotton and the nylon was 30s.

Specimens of the single cotton yarn with the same twist multiple were plyed into specimens of two-ply yarns with varying twist per inch. This procedure was followed until each specimen of the single twist multiples had been two-plyed into a series of sample ply yarns with varying twist per inch.

Thus, all the ply yarn samples represented different combinations of single yarn twist and ply yarn twist. The samples were 100 per cent cotton ply yarn and 100 per cent nylon ply yarn. The twist in the singles was in the "Z" direction, and the twist in the ply was in the "S" direction. All ply yarns were tested for count, twist per inch, and breaking strength. The count-strength products were used in comparing the yarns.

It was found that, when the yarns were grouped together on the basis of a ratio of the square of the single twist multiple divided by the ply turns per inch, the yarns could be successfully compared to each other for the best strength. All cotton ply yarns were placed in one series of ratio groups for comparison, and all nylon ply yarns were put in another series of ratio groups.

It was established that for each ratio group, for cotton as well as nylon, that the count-strength products were related to the single twist multiples. By plotting single twist multiples against the count-strength products for each ratio group, it was further established that the best strengths for both cotton and nylon were in the higher ratio groups.

CHAPTER I

INTRODUCTION

The number of turns per inch that a single yarn should have for maximum strength has been well defined and accepted for many years in the textile industry. The number of turns is expressed in terms of a twist multiple and the count of the yarn. The twist multiple is the ratio of the turns per inch divided by the square root of the count of the yarn. It has been generally conceded that the ratio of 4.75 gives the best strength for single all-cotton yarn counts. However, when two single yarns are twisted together to make a ply yarn, the identity of the single yarn in terms of tensile strength and twist is lost. Very little can be found in the textbooks and literature regarding the relationship of twist and tensile strength in the single yarn to the twist and tensile strength of the ply yarn.

The Problem

It was the purpose of this study to relate the tensile strength of ply yarns to the tensile strength of single yarns in terms of twist per inch in the ply as related to the twist per inch in the single yarn. The factor of twist was selected to show this relationship because it more than any other affects the strength of staple yarns. When a textile mill is confronted with making a two-ply yarn, the question immediately arises as to what twist per inch in the single yarn should be combined with what twist per inch in the two-ply yarn. The

problem is solved by a few trials until a two-ply yarn is obtained that meets the specifications; however, it is never known whether the best product of ply yarn was manufactured or not. In this study an attempt has been made to solve this problem.

Definition of Terms Used

Twist.--The turns about its axis, per unit of length, observed in a fiber, yarn or cord.

Twist in the "S" and "Z" Directions.--A yarn or cord has a "S" twist if when held in a vertical position, the spirals conform in the direction of slope to the central portion of the letter "S", and "Z" twist if the spirals conform in the direction of slope to the central portion of the letter "Z".

Twist Resultant of a Yarn.--When a single yarn with a "S" twist is twisted together in a two-ply yarn in the direction of "Z" twist, the difference in turns per inch in the single yarn between the turns per inch in the ply yarn will be expressed in this thesis as a resultant in the "S" or "Z" direction, depending on which was the greater of the two.

Yarn Count.--In the cotton system for numbering yarns, the count of a yarn is the number of 840 yard lengths per pound. The count is designated as this number followed by a small letter "s".

Hank Roving (HR)--Whereas, count is used to designate the product of the spinning frame, hank roving is used to designate the product of the roving frame. It is the same numerically as count but is a loosely twisted product with a much heavier weight per unit length than yarn.

Denier.--A unit of a yarn numbering system used commonly with filament

yarns. A denier is equal numerically to the number of grams per 9000 meters.

Twist Multiple or Twist Factor.--This factor is the ratio of the twist per inch divided by the square root of the yarn count.

Method of Attack

The yarn count of 30s was selected for both nylon and cotton yarns. Specimens of these yarns with a range of low to high twist multiples were then spun from a selected stock of Egyptian cotton roving and also from a nylon staple roving. No blending was performed in this study and only 100 per cent cotton or 100 per cent nylon yarns were made.

Each specimen of single twist was then two-plyed and twisted into specimens of ply twist, ranging from a low to a high twist in the two-ply. The combinations of single twist with twist in the two-ply were numerous, and each specimen of ply yarn was labeled in its proper series.

The single yarn specimens as well as the ply yarn specimens were given a series of tests for counts, twist per inch, and breaking strengths. Next a base for comparison of all the numerous combinations had to be considered. It was decided to group all the ply yarn specimens together when they had the same difference in single and ply twist. These groups were evaluated for the best ply yarn strength. The twist resultants of the ply yarn were thought to represent a balance of twist in the yarn, and an attempt was made to relate the balance of twists for the best ply yarn strengths. However, the data as analyzed did not show that the resultant was a prime indicator of ply yarn strength, and

another approach to the problem was made. Next, the ratio of the twist multiple squared of the single yarn divided by the ply turns per inch was used as an indicator of ply yarn strength. This method proved more successful.

Review of Previously Related Literature

In general very little could be found on ply yarn strength from the standpoint of relating twist in the single yarn to twist in the ply yarn. It was noted that a correlation had been found between skein and single end breaking strength of ply yarns, and that the effect of twist on ply yarn contraction had been related by Zobel(1). This work was done by the analysis of yarn diameter, single and ply, with a microscopic technique. Other studies could be found on the measurement of helix angles of ply yarns. Several formulas for yarn diameters, single and ply, could also be found.

The formula below which gives a predicted number of turns left in a single yarn as it rests in the ply yarns, provided the twist per inch in the singles exceeds the twist per inch in the ply, was the closest approach to the problem of ply strength. It was from this formula that the writer gained the idea of using this ratio as an indicator of ply yarn strength.

$$\text{Turns per inch remaining in a single yarn} = \frac{K\ (\text{Single T.M.})^2}{\text{Ply Turns per Inch}}$$

In this formula K would vary with the counts of the single yarn and as long as the single twist exceeded the ply twist in an opposite

direction, this formula would give a close approximation of the turns per inch remaining in a single yarn. However, in this study the ratio of the single twist multiple squared divided by the ply turns per inch has been used as an indicator of ply yarn strength regardless of the amount of ply turns per inch.

CHAPTER II

THE PROCEDURE

Materials and Equipment.--The materials used in this study included Egyptian cotton roving which was obtained from the Clark Thread Company, Austell, Georgia, and nylon roving which was obtained from the Newnan Cotton Mills, Newnan, Georgia. Nylon was selected for this study in addition to cotton, so that a modern synthetic fiber would be represented as well as a natural fiber.

The regular cotton mill processing equipment located in the A. French Textile School of the Georgia Institute of Technology was used in this study. The pieces of equipment used included the following: one Saco-Lowell Long Draft Spinning frame, one Whitin Model B twister, one Brown and Sharpe Company Roving Reel, one Brown and Sharpe Company Yarn Reel, one Christian-Becker Company Chainomatic Analytical Balance (with gram weights), one Alfred Suter Twist Counter, one Goodbrand Company Twist Counter, one Henry Scott I.P. 2 Single Strand Yarn Tester, one Alfred Suter Vertical Single Strand Yarn Tester, and one Niagara Company Air Conditioning Unit with Westinghouse Company controls and Foxboro Company Temperature and Humidity Recorder.

The facilities of the standard conditioned Physical Testing Laboratory of the A. French Textile School were used in making the various tests on the spun yarn samples.

Experimental Operations.--The Egyptian cotton roving selected for this

work was of uniform quality. It normally would have been made into yarns for sewing thread, and cotton sewing thread requires the best quality, combed long staple stock. The staple length in this case was 1 $^{13}/32$ inches, and the hank roving number was 4.4 HR.

The nylon staple roving was two and one-half inches in staple length. The denier of the nylon was 3.0 and the hank roving number was 3.0 HR.

The Saco-Lowell Long Draft Spinning Frame used in this study was ideally adapted for both types of fibers, since the cotton roving could be made into yarn on one side of the frame, the "Roth" side of the frame, and the nylon roving could be made into yarn on the other side of the frame, the "Z" side of the frame.

It was decided to spin a count of 30s for both cotton and nylon. This count of yarn in the singles is commonly made into a two-ply yarn and it was desired to test a two-ply yarn that was made of an average count as used by the textile industry.

Sixteen bobbins of yarn were spun first with the twist multiple of 2.50. Next, the twist multiple of 2.75 was used, and thus the twist multiple was increased by 0.25 until the twist multiple of 6.00 was run in the case of cotton. The last twist multiple used in the case of nylon was 5.50. In figuring the twist constant to use in calculating the twist gears for each of the twist multiples, the twist per inch produced in a sample of the yarn run was multiplied by the actual gear that had been used on the machine. Since this constant was very close to the theoretical constant, it, rather than the theoretical constant was used, as it allowed for tape slippage, traveler lag, and yarn

contraction. The single yarns produced had, within very close limits, the twists predicted for each twist multiple. Forty breaking strengths were then recorded for each twist multiple on the Suter single strand yarn tester. This tester was located in the Physical Testing Laboratory where standard testing conditions are maintained as specified by the American Society for Testing Materials. The Standard Atmosphere is that atmosphere having a relative humidity of 65 per cent as 70 degrees F. A tolerance of plus or minus 2 per cent in relative humidity and plus or minus 2 degrees F. in temperature is allowed(2). The single yarn strengths were then compared with the single yarn twist multiples.

The Whitin Model B Twister was used in two-plying the single yarn. Two single yarns that had the same twist were two-plyed into a series of varying ply yarn twists. This procedure was followed until all twist multiples for single yarns had been twisted together with varying twists in the two-ply.

As in the case of the spinning frame the twist constant was figured by taking the actual twist per inch in a specimen of yarn and multiplying it by the twist gear used at the time. When this constant was compared to the theoretical constant, only a small difference, due to twist contraction, tape slippage, and traveler lag, could be noted between it and the theoretical constant. However, in the case of ply yarn twist per inch, specific twist per inch tests were run for each bobbin of two-ply yarn. Each bobbin of two-ply yarn produced was given an identifying number, and ten ply twist samples were taken from the bobbin and recorded with the identifying number for the bobbin. This procedure was thought important because even though there was less variation in

ply yarn twist than in single yarn twist, the average twist might be consistently higher or consistently lower than the predicted twist for the bobbin.

Therefore, in the same theme of treating each ply yarn bobbin as a unity with its own ply twist conditions, the count of the ply yarn was recorded from a series of count measurements on the bobbin. Then forty single strand breaking strengths were taken from the bobbin and recorded. Other bobbins of ply yarn, representing different combinations of single and ply twist were treated in the same manner.

All of the twist in the single yarn was in the "Z" direction. All of the twist in the ply yarn was in the "S" direction. This system was used as it is the most common practice of textile mills. Also, most of the combinations of ply and single twist were the cases of a low twist in the singles combined with a high twist in the ply so that most of the resultants of twist were on the "S" side. This procedure was followed to a lesser extent with nylon, and almost as many resultants were on the "Z" as the "S" side.

After the twist samples, breaking strength samples, and count samples were taken for each ply yarn specimen, the difference in single and ply twist was recorded as a resultant in the "S" or "Z" direction for each ply yarn specimen.

Ranges of resultants were set up which progressed from the highest "Z" resultant to zero, where the "Z" and "S" twist were equal, and then from the lowest "S" resultant to the highest "S" resultant.

Since the ply yarn twist varied slightly, the number of specimens of ply yarn to serve as samples of each resultant range varied from

three to five or seven.

When this study had progressed to this point of the formation of samples into groups of resultant ranges of twist, the procedure was to treat the data as in a spinning evaluation test. The best strength of each resultant range group was calculated by fitting a straight line, using the method of least squares, to the count strength products of the various yarn counts, calculating the point at which this line intersects the ordinate for the count chosen, and dividing this value by the count chosen to obtain the index of best strength. The count chosen is an arbitrary one, and in this case was 15s. This index of yarn strength, called the "Weighted Average" strength, was developed by the United States Department of Agriculture(3).

The next approach to the problem of ply yarn strength was based on the ratio of the square of the single twist multiple divided by the ply turns per inch. On this basis the data was regrouped for study.

TABLE 1. OPERATING DATA FOR SACO LOWELL LONG DRAFT SPINNING FRAME

ROTH SIDE WITH EGYPTIAN COTTON

Hank Fed	4.4
Ends Fed	2
Count Delivered	30s
Draft	14.3
Draft Gear	40
Draft Constant	573
Twist Multiples	2.50 - 6.00
Twist Gears	32 - 77
Twist Constant	976

Z SIDE WITH NYLON STAPLE

Hank Fed	3.0
Ends Fed	2
Count Delivered	30s
Draft	21
Draft Gear	27
Draft Constant	573
Twist Multiples	2.50 - 5.50
Twist Gears	35 - 77
Twist Constant	976

ROTH AND Z SIDES

Cylinder Diameter	8"
Whorl Diameter	1-1/8"
Front Roll Diameter	1"
Ring Diameter	1-3/4"

TABLE 2. OPERATING DATA FOR WHITIN MODEL B TWISTER

Counts Fed	30s
Ends Fed	2
Twist Constant Top Roll	1568
Twist Constant Bottom Roll	700
Twist Gears Top Roll	31 - 39
Twist Gears Bottom Roll	20 - 68
Cylinder Diameter	8"
Front Roll Diameter	1½"
Whorl Diameter	1-5/8"
Ring Diameter	2½"

CHAPTER III

TESTS CONDUCTED

All yarn tests were conducted in the Physical Testing Laboratory under standard conditions, and tests described herein were made according to the standards set by the American Society for Testing materials (4).

The untwist-twist method was used to determine the twist per inch in the single yarn. A ten-inch sample was inserted in the jaws of the Goodbrand Tester. The tension on the yarn was applied so that the indicator was at the top mark. As the yarn was untwisted, the indicator went to the bottom mark. Then, as the untwisting continued, the point was reached where all the twist was out and the continued revolving of the jaws at one end tended to twist the yarn together again, so that the yarn contracted and raised the indicator back towards the top mark. The twisting was continued until the indicator reached its starting point at the top mark. Since the total number of turns represents the turns required to take all the twist out and put back into the yarn the same amount of twist, this total is divided by two and the resulting figure is divided by ten to get the turns per inch. Fifteen samples were taken for each specimen, and the average of the fifteen twist tests was taken.

The yarn number or count of the single yarn was determined by reeling 120 yard samples and weighing the samples on the Christian-

Becker Chainomatic Balance. The length and weights were put in the following formula to determine the counts:

$$\text{Yarn Numbers} = \frac{\text{Length(Yards)}}{\text{Weight(Grains)}} \times \frac{7000}{840}$$

The counts for ply yarn was determined by the same procedure and formula, except that samples were required to be only 24 yards in length. The number of samples for each specimen was 25 in the case of counts. The specified number of yards of a specimen was reeled off on a Brown and Sharpe Company Yarn Reel. The weights taken on the Christian-Becker Chainomatic Balance were accurate to 0.0001 of a grain. The reading in grams was converted to grains for the yarn number formula.

The twist per inch for the two-ply yarn was determined by the Suter Twist Counter. In this test ten inch specimens were inserted between the jaws of the twist counter and the yarn untwisted in each case until the two single strands of yarn were separated entirely along the ten inch length. Ten tests were conducted for each specimen.

Breaking strengths for single and ply yarns were tested by the Suter Vertical Single Strand Yarn Tester (oil plunger type). Specimens were tested between the jaws which were ten inches apart. Care was taken to make certain no twist was lost in inserting the specimen in the jaws of the yarn tester. If the yarn broke at the jaw the results were discarded. Forty samples were taken for each specimen of yarn. The yarn tester was calibrated by the specifications of the American Society for Testing Materials. The rate of descent of the lower jaw was set at twelve inches per minute.

CHAPTER IV

RESULTS

An example illustrating the system of finding the weighted average by fitting a straight line, using the method of least squares, to the count strength products is shown in Table 3. This method was applied to groups of ply yarn data having the same twist resultant evaluation. A condensation of the results is shown on Table 4 for cotton and nylon. The resultants shown are averages for each range of resultants that were grouped together for evaluation.

Tables 5 - 14 show the ply yarn data grouped on the basis of the ratio of single twist multiple squared divided by the ply turns per inch.

Figures 1 - 7 show the results of Tables 5 - 14 plotted with single twist multiples on the horizontal against count strength products on the vertical.

As it was not feasible to include in detail the breaking strengths for the cotton and the nylon, only the cotton breaking strengths are shown in detail, Tables 17 - 98, and the average of forty ply breaking strengths for each nylon ply combination are shown in Tables 9 - 14. It is noted that nylon ply turns per inch are also shown in Tables 9 - 14, as they had not been given in detail previously, as had the cotton turns per inch in Tables 17 - 98.

Tables 15 - 16 show the equivalent ranges of ply turns per inch

for various ratios.

Discussion of Results.--The results shown in Table 4 give lower breaking strength with the resultants from S-14 to S-33 for cotton. However, in general the results shown in Table 4 for cotton and nylon are variable and not conclusive.

In Tables 5 - 8 for cotton the count-strength products for each ratio vary regularly from low to high and back to a low point as the single twist multiple progresses.

In Tables 9 - 14 for nylon the count strength products for each ratio vary regularly from a high point to a low point as the single twist multiple progresses.

The clue that the ratio of single twist multiple squared divided by the ply turns per inch might be an indicator of ply yarn strength was taken from the formula (6):

$$\text{Turns per inch remaining in a single yarn} = \frac{K(\text{Single T.M.})^2}{\text{Ply Turns per inch}}$$

This formula could be used for all cases where the single twist per inch exceeded the ply twist per inch. The constant K varied with the counts. Although all the calculations were on the basis of predicting twist in the singles and verifying the results experimentally, it was thought that this ratio would be a good indicator of ply yarn strength, even if the ply turns per inch exceeded the single turns per inch. It was surmised that as the single twist multiple increased the ply turns per inch had to increase proportionally if the same ratio was maintained. Therefore with both single and ply twist being increased, a

trend in the count-strength products within each ratio should be indicated as in Tables 5 - 14.

It is noted in Tables 15 - 16 that as the ratio increases the low and high limits of the range of single twist multiples for best strength also increase. It is noted at the same time that the range of ply turns per inch converges to smaller and smaller limits. This is true for cotton as well as nylon.

From Figures 1 - 7 a trend of higher count-strength products with higher single twist multiples can be seen as the ratio increases.

Conclusions.--The results that have been given, relating ply yarn strength to a twist resultant, indicate that the twist resultant is not an effective measure of ply yarn strength.

The ratio of the square of the single twist multiple divided by the ply turns per inch has been shown to be a prime indicator of ply yarn strength.

When this ratio is constant with the single twist multiple increasing, the count-strength products of the ply yarns will progressively vary from low to high or from high to low for cotton yarns, and from high to low for nylon yarns.

The trend has also been established that as this ratio increases the range of single twist multiples giving the best strengths also moves forward with its low and high limits.

It can be stated that the higher the single twist multiple, the more narrow is the range of ply turns per inch that will give the best strength.

It can be stated that the ply yarns, in the combinations possible for the higher ratios, are more consistently in the higher strength brackets than the ply yarns with combinations possible in the lower ratios.

It is, therefore, further concluded that the best strengths are found in the higher ratio groups.

TABLE 3. EXAMPLE OF USING THE WEIGHTED AVERAGE BY FITTING A STRAIGHT LINE USING THE METHOD OF LEAST SQUARES, TO THE COUNT-STRENGTH PRODUCTS FOR COTTON RESULTANT GROUP Z - 6

DATA:

Count X	Strength	Count-Strength Product Y	XY	X^2
16.27	1.92	31.24	508.27	264.71
15.13	1.91	28.90	437.25	228.91
16.40	1.57	25.74	422.13	268.96
15.70	1.82	28.57	448.55	246.49
63.50	7.22	114.45	1816.20	1009.07

EQUATIONS:

$$Y = MX + b$$

$$\Sigma Y = MX + Nb$$

$$\Sigma XY = M\Sigma X^2 + b\Sigma X$$

CALCULATIONS:

$$63.50\,M + 4\,b = 114.45$$

$$1009.07\,M + 63.50\,b = 1816.20$$

$$\underline{-1007.74\,M \quad -63.50\,b = -1816.32}$$

$$1.33\,M = -.12$$

$$M = -.09022$$

$$4b = 114.45 - 63.50\,(-.90922)$$

$$b = 30.045$$

$$Y = MX + b$$

$$Y = -.09022\,(15) + 30.045$$

$$Y = 28.690$$

$$\text{Index} = \frac{Y}{X} \quad \frac{28.690}{15} = 1.912$$

TABLE 4. BEST STRENGTH INDEXES FOR COTTON AND NYLON 30/2 STAPLE YARN IN TERMS OF THE TWIST RESULTANTS OF THE YARNS

RESULTANTS	COTTON INDEX	NYLON INDEX	RESULTANTS
Z - 6	1.912	2.370	Z - 16
Z - 4	1.982	2.330	Z - 14
Z - 3	2.106	2.245	Z - 11
Z - 2	2.080	2.200	Z - 8
0	2.070	2.372	Z - 5
S - 2	1.997	2.174	Z - 3
S - 3	1.994	2.302	0
S - 4	2.028	2.159	S - 2
S - 6	2.176	2.150	S - 3
S - 8	2.096	2.280	S - 6
S - 10	2.048	2.210	S - 8
S - 12	1.940	1.780	S - 10
S - 14	2.101	2.178	S - 14
S - 15	1.927	1.824	S - 16
S - 17	2.062	1.386	S - 20
S - 20	2.064	1.908	S - 24
S - 23	2.073	2.063	S - 27
S - 25	1.890	2.234	S - 33
S - 29	1.740		
S - 33	1.510		

Table 5. Cotton 30/2 Yarns Grouped by the Ratio of the Square of the Single Twist Multiple Divided by the Ply Twist per Inch.

Ratio .20-.30

Single T.M.	Counts	Strength	Count-Strength Product
2.50	16.25	1.94	31.5
2.50	14.80	2.20	32.5
2.50	14.10	2.19	30.8
2.75	15.00	2.12	31.8
3.00	15.00	2.14	32.1
3.00	15.05	1.99	29.9
3.25	13.60	2.31	31.4
3.50	13.10	1.84	24.1

Ratio .30-.40

Single T.M.	Counts	Strength	Count-Strength Product
2.50	15.25	1.93	29.4
2.50	16.85	2.15	36.0
2.75	14.85	2.35	34.9
3.00	16.40	2.23	36.5
3.25	14.70	2.24	32.9
3.50	13.80	2.30	31.7
3.50	13.50	2.25	30.3
3.75	14.32	2.14	30.6
3.75	14.15	1.88	26.6
4.00	14.24	1.88	26.7
4.25	11.53	2.06	23.7

Table 6. Cotton 30/2 Yarns Grouped by the Ratio of the Square of the Single Twist Multiple Divided by the Ply Twist per Inch.

Ratio .40-.50

Single T.M.	Counts	Strength	Count-Strength Product
2.75	16.1	1.97	31.0
3.00	15.6	2.18	34.0
3.25	15.35	2.27	34.8
3.50	15.60	2.09	32.6
3.75	13.94	2.25	31.3
4.00	12.82	2.42	31.0
4.25	13.49	2.35	31.0
4.50	12.04	2.01	24.2
4.75	13.35	1.92	23.2
4.75	12.40	1.68	20.8
5.00	13.10	1.68	22.0
5.00	12.21	1.42	17.3

Ratio .50-.60

Single T.M.	Counts	Strength	Count-Strength Product
2.50	16.20	1.77	28.6
3.25	14.70	2.20	32.3
3.75	14.00	2.40	33.6
4.00	15.12	2.13	33.0
4.25	15.84	2.12	33.5
4.50	14.96	2.08	31.1
5.00	14.57	1.82	26.5
5.25	12.36	1.69	2.08
5.50	12.70	1.39	17.3

Table 7. Cotton 30/2 Yarns Grouped by the Ratio of the Square of the Single Twist Multiple Divided by the Ply Twist per Inch.

Ratio .60-.70

Single T.M.	Counts	Strength	Count-Strength Product
2.50	16.85	1.52	25.6
3.00	15.70	1.87	29.3
3.50	16.27	1.90	30.9
4.00	16.29	2.13	34.7
4.25	16.26	2.06	33.5
4.50	13.96	2.21	30.8
4.75	13.85	2.05	28.5
5.00	12.00	2.26	27.0
5.25	13.61	1.92	25.1
5.50	12.40	1.79	22.2

Ratio .70-.80

Single T.M.	Counts	Strength	Count-Strength Product
2.75	16.75	1.49	24.9
3.25	15.40	1.87	28.7
3.75	14.50	2.29	33.2
4.50	13.70	2.25	31.9
4.75	14.46	2.06	29.8
5.00	14.50	2.15	31.2
5.20	14.54	1.99	28.8
5.50	15.47	1.72	27.0
5.75	13.47	2.02	27.2
6.00	14.67	1.54	22.6

Table 8. Cotton 30/2 Yarns Grouped by the Ratio of the Square of the Single Twist Multiple Divided by the Ply Twist per Inch.

Ratio .80-.90

Single T.M.	Counts	Strength	Count-Strength Product
3.00	16.40	1.57	25.7
4.00	16.68	1.94	32.3
4.75	15.40	2.16	33.0
5.25	15.20	1.98	30.0
5.50	15.70	1.78	28.1
6.00	13.77	1.66	23.8

Ratio .90-1.00

Single T.M.	Counts	Strength	Count-Strength Product
3.75	16.27	1.92	31.2
4.25	15.24	2.07	31.5
4.50	15.73	2.04	32.0
5.00	15.79	1.99	31.4
5.50	14.78	1.90	28.1
5.75	14.50	1.91	2.77
6.00	14.29	1.86	18.6

Ratio 1.00-1.20

Single T.M.	Counts	Strength	Count-Strength Product
3.25	15.70	1.82	28.5
4.75	15.13	1.90	28.7
5.25	14.60	2.21	32.2
5.50	13.73	2.13	29.2
5.75	16.01	1.78	29.0
6.00	13.41	1.96	26.3

Table 9. Nylon 30/2 Yarns Grouped by the Ratio of the Square of the Single Twist Multiple Divided by the Ply Twist per Inch.

Ratio .10-.20

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
2.50	13.72	2.00	34.5	27.4
2.50	13.20	2.00	40.8	26.4
2.75	12.76	1.92	39.7	24.5
2.75	11.97	1.87	48.9	22.5
3.00	11.46	1.89	54.0	21.6
3.25	11.42	1.78	54.0	20.3

Ratio .20-.30

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
2.50	13.72	2.14	28.2	29.4
2.75	14.22	2.11	28.2	30.0
2.75	12.97	2.13	34.1	28.0
3.00	13.73	1.94	32.1	26.6
3.00	12.84	2.05	39.5	26.2
3.25	13.16	2.09	34.0	27.4
3.25	12.35	2.15	37.0	26.6
3.25	12.24	1.98	44.3	24.4
3.50	11.72	2.02	44.0	23.6
3.50	10.87	1.78	52.1	19.2
3.75	10.80	1.64	52.2	17.8

Table 10. Nylon 30/2 Yarns Grouped by the Ratio of the Square of the Single Twist Multiple Divided by the Ply Turns per Inch.

Ratio .30-.40

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
2.50	14.12	2.32	20.2	32.7
2.75	14.50	2.36	20.3	34.2
3.00	14.00	2.25	26.7	31.5
3.25	13.56	2.27	27.2	31.0
3.50	13.20	2.10	32.0	27.7
3.50	13.56	1.98	39.5	27.0
3.75	11.84	2.23	39.7	26.3
3.75	10.61	2.13	43.0	22.6
4.00	11.80	1.87	43.2	22.0
4.00	11.30	1.80	52.4	20.4
4.25	11.81	1.85	52.0	21.0

Ratio .40-.50

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
2.50	14.95	2.17	15.3	32.5
3.00	14.72	2.10	19.8	31.0
3.50	13.91	2.17	27.5	30.3
3.75	12.30	2.40	32.2	29.5
4.00	11.60	2.22	39.4	25.6
4.25	13.29	1.91	38.7	25.2
4.25	12.11	1.91	43.2	23.4
4.50	13.00	1.91	43.7	24.5
4.75	11.55	1.78	52.2	20.6

Table 11. Nylon 30/2 Yarns Grouped by the Ratio of the Square of the Single Twist Multiple Divided by the Ply Turns per Inch.

Ratio .50-.60

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
2.75	15.47	2.25	15.0	35.0
3.25	15.00	2.09	19.7	31.4
3.75	13.15	2.25	27.3	29.5
4.00	12.42	2.45	33.4	30.1
4.25	13.05	2.11	32.1	27.5
4.50	13.60	1.96	39.5	26.6
4.75	12.17	1.94	44.2	23.6
5.00	12.02	1.82	52.0	22.0
5.25	11.25	1.85	52.5	20.5
5.50	11.01	1.75	52.4	19.5

Ratio .60-.70

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
2.50	15.28	2.22	10.0	34.0
3.00	15.84	2.13	14.9	33.6
3.25	14.46	2.35	14.8	34.0
3.50	14.77	2.37	19.7	34.5
4.00	13.65	2.33	26.7	32.0
4.25	13.61	2.34	27.0	32.0
4.50	13.87	2.10	33.0	28.4
4.75	12.77	2.19	39.5	28.0
5.00	14.10	1.90	39.2	27.0
5.00	12.61	1.96	44.2	24.8
5.25	11.89	1.90	43.7	22.3

Table 12. Nylon 30/2 Yarns Grouped by the Ratio of the Square of the Single Twist Multiple Divided by the Ply Turns per Inch.

Ratio .70-.80

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
2.75	14.14	2.48	9.9	35.0
3.75	13.88	2.52	19.1	35.0
4.00	14.35	2.25	19.6	32.4
4.50	14.52	2.20	26.7	32.0
4.75	12.29	2.31	32.0	28.4
5.25	13.02	1.98	39.4	25.8
5.50	11.29	1.81	42.1	20.4

Ratio .80-.90

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
3.50	14.52	2.44	14.5	35.5
4.75	14.74	2.25	27.0	33.0
5.00	13.49	2.13	32.0	28.8
5.50	12.61	2.10	39.4	26.5

Ratio .90-1.00

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
3.00	14.46	2.34	10.2	34.0
3.75	14.54	2.37	15.3	34.4
4.25	13.95	2.29	19.8	32.0
5.25	13.25	2.24	32.7	29.6

Table 13. Nylon 30/2 Yarns Grouped by the Ratio of the Square of the Single Twist Multiple Divided by the Ply Turns per Inch.

Ratio 1.00-1.20

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
3.25	15.20	2.18	9.9	33.2
4.00	14.92	2.28	14.8	34.0
4.50	13.85	2.40	19.6	33.2
5.00	13.99	2.25	26.8	31.4
5.25	13.57	2.21	27.0	30.5
5.50	14.85	2.21	26.5	32.2
5.50	13.28	2.14	32.3	28.4

Ratio 1.20-1.30

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
3.50	14.19	2.42	10.2	34.4
4.25	14.11	2.42	14.7	34.1
4.75	14.55	2.45	19.4	35.6
5.00	14.43	2.26	19.6	32.6

Ratio 1.30-1.50

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
3.75	15.12	2.33	10.4	35.1
4.50	14.92	2.25	15.0	33.5
5.25	13.64	2.43	19.2	33.0

Table 14. Nylon 30/2 Yarns Grouped by the Ratio of the Square of the Single Twist Multiple Divided by the Ply Turns per Inch.

Ratio 1.50-1.70

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
4.00	14.57	2.18	9.7	31.8
4.75	14.55	2.35	14.3	34.0
5.50	15.30	2.19	18.7	33.5

Ratio 1.70-2.20

Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
4.25	14.44	2.50	9.9	36.0
4.50	15.10	2.32	9.7	35.1
5.00	14.30	2.38	13.6	35.4
5.25	14.29	2.35	13.3	33.4

Ratio 2.20-2.70

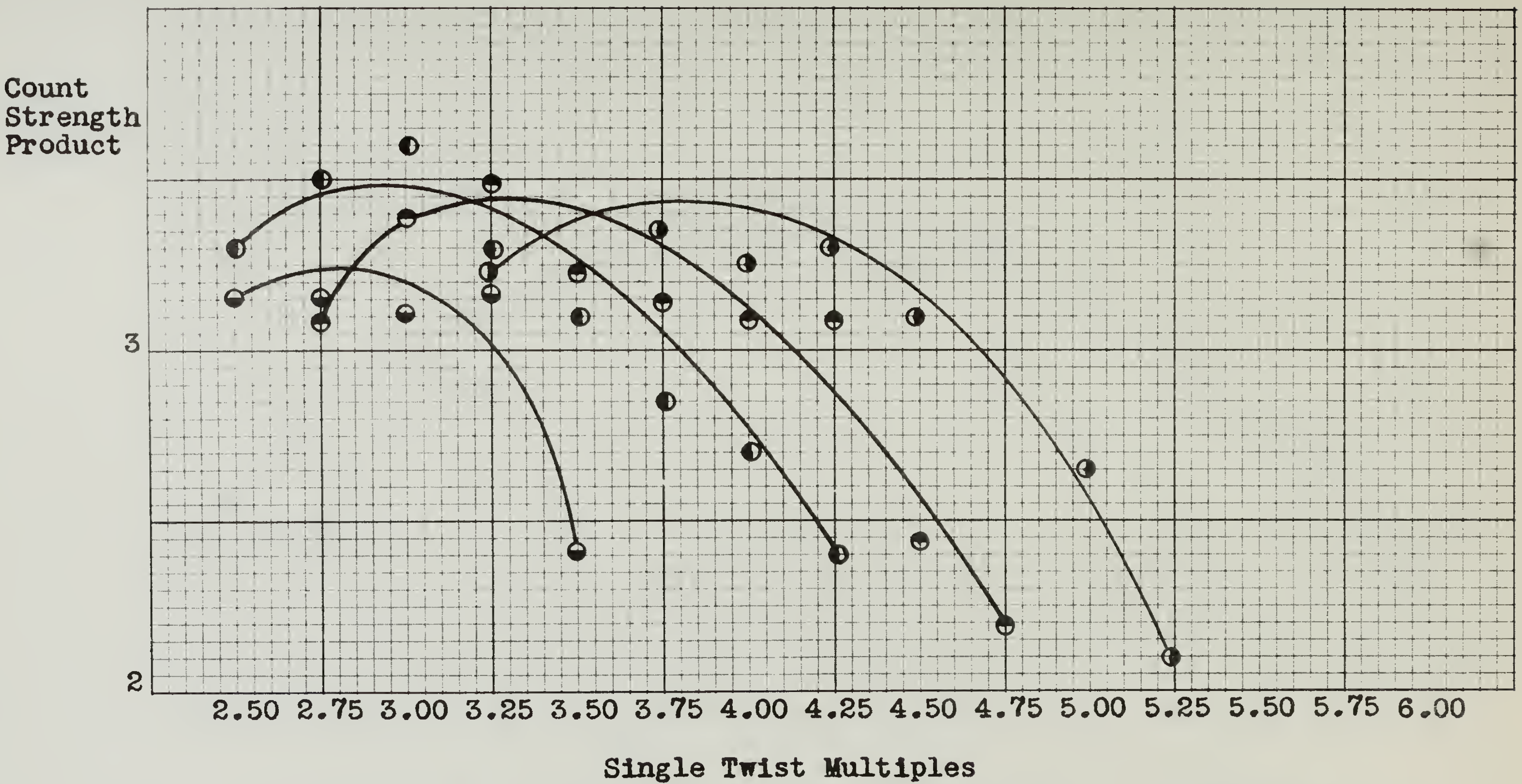
Single T.M.	Counts	Strength	Ply T.P.I.	Count-Strength Product
4.75	14.03	2.42	10.2	34.0
5.00	14.64	2.47	10.0	36.2
5.25	15.13	2.35	9.7	35.5
5.50	14.31	2.36	9.9	33.8
5.50	14.30	2.38	13.5	34.0

Table 15. Comparison of the Ratio of the Square of the Single Twist Multiple Divided by the Ply Twist per Inch for Cotton 30/2 Ply Yarns.

Ratio	Range of Single Twist Multiples for Best Strength	Range of Ply Twist per Inch
.20 - .30	2.50 - 3.25	20 - 50
.30 - .40	2.50 - 3.60	15 - 43
.40 - .50	2.75 - 4.10	15 - 42
.50 - .60	3.00 - 4.60	15 - 42
.60 - .70	3.00 - 4.75	13 - 37
.70 - .80	3.25 - 5.00	13 - 36
.80 - .90	3.50 - 5.25	13 - 34
.90 - 1.00	3.75 - 5.25	13 - 30
1.00 - 1.20	4.00 - 5.50	13 - 30

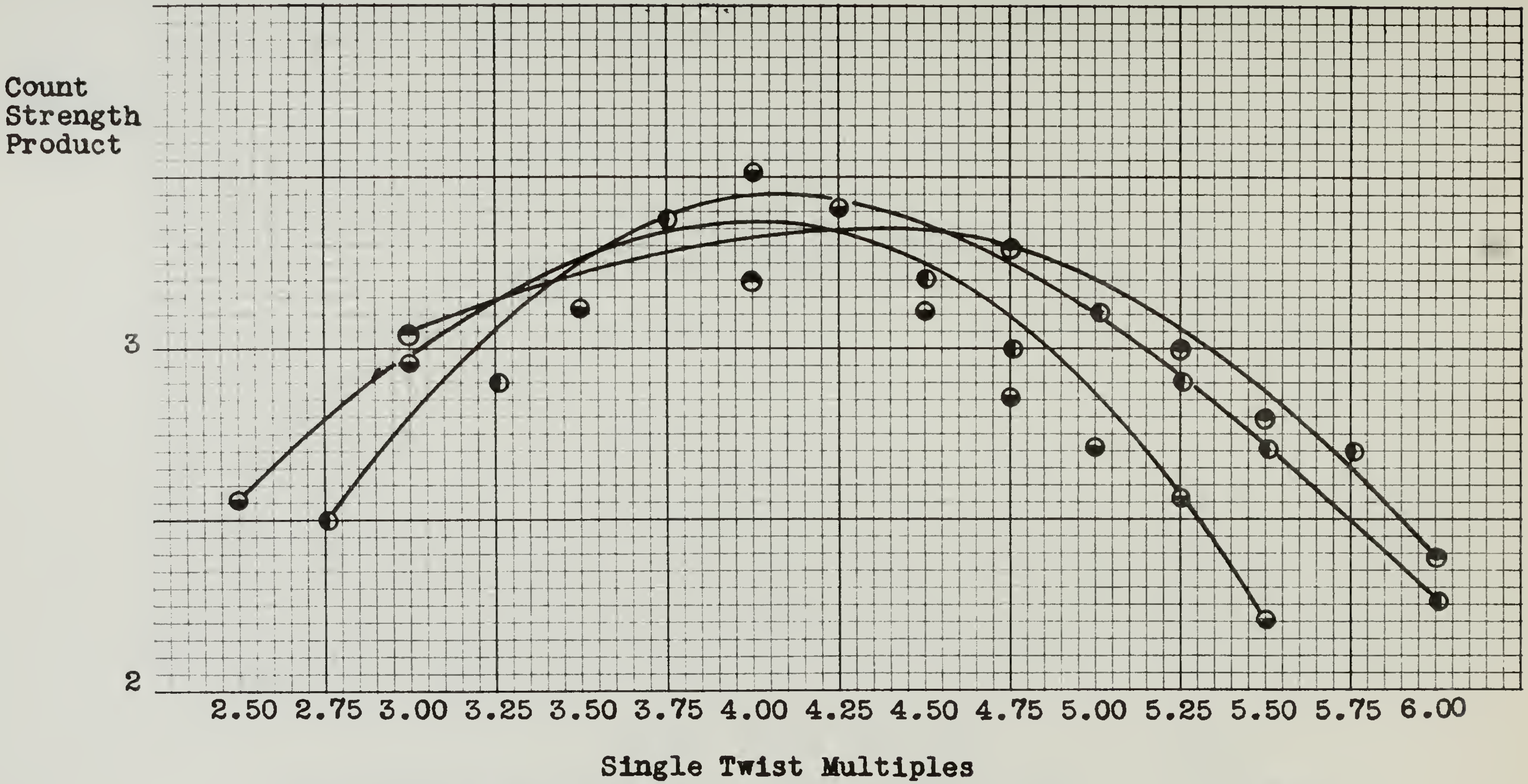
Table 16. Comparison of the Ratio of the Square of the Single Twist Multiple Divided by the Ply Turns per Inch for Nylon 30/2 Ply Yarns.

Ratio	Range of Single Twist Multiples for Best Strength	Range of Ply Turns per Inch
.30 - .40	2.50 - 3.25	15 - 35
.40 - .50	2.50 - 3.50	12 - 34
.50 - .60	2.75 - 4.00	12 - 34
.60 - .70	3.00 - 4.50	12 - 34
.70 - .80	3.00 - 4.90	12 - 34
.80 - .90	3.25 - 5.10	12 - 32
.90 - 1.00	3.50 - 5.10	12 - 29
1.00 - 1.20	3.50 - 5.50	10 - 30
1.20 - 1.30	3.50 - 5.50	9 - 25
1.30 - 1.50	3.75 - 5.50	9 - 23
1.50 - 1.70	4.00 - 5.50	9 - 21
1.70 - 2.20	4.25 - 5.50	8 - 18
2.20 - 2.70	4.25 - 5.50	6 - 14



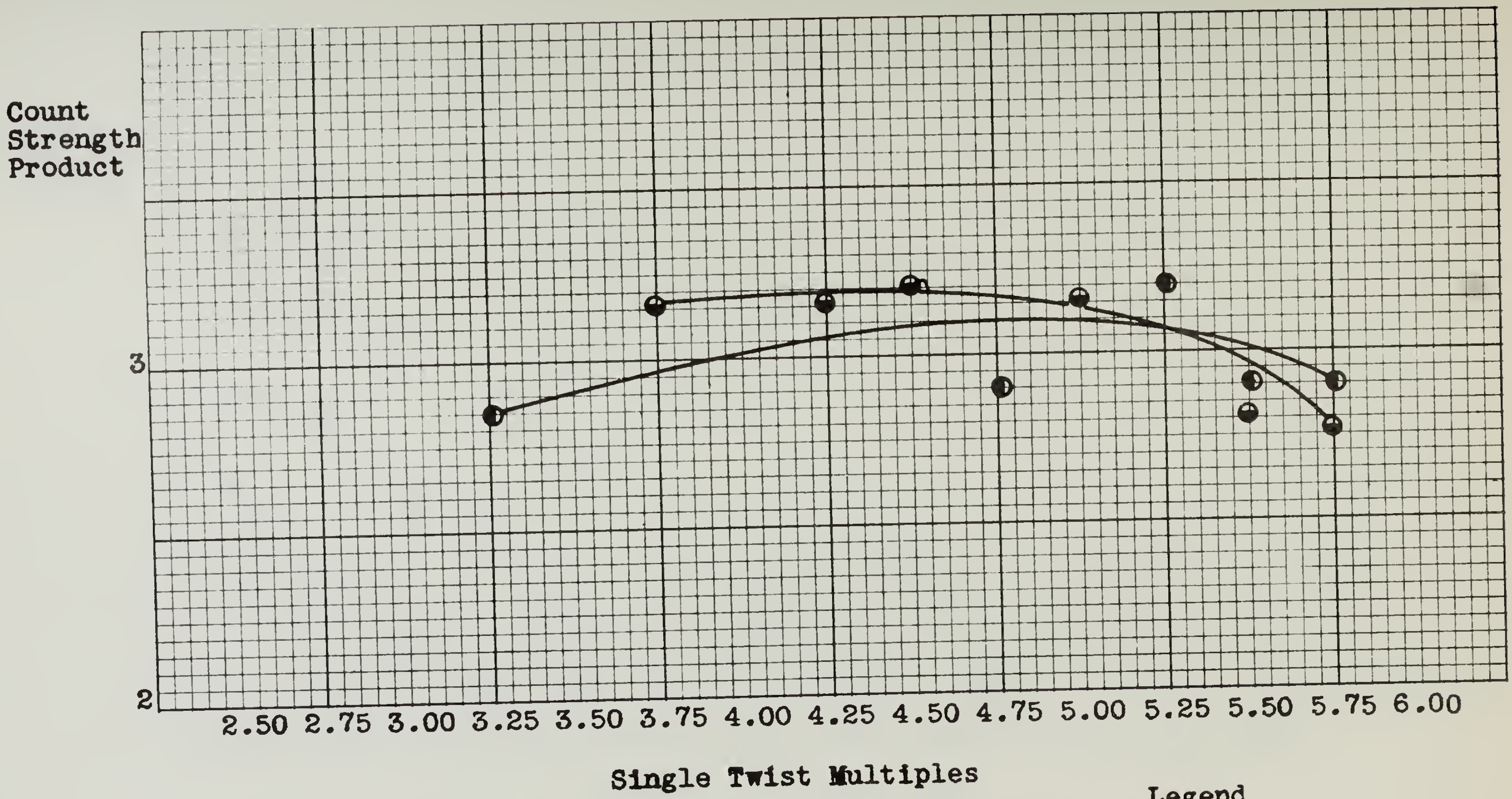
DISTRIBUTION OF THE RATIOS OF THE SQUARE OF THE SINGLE TWIST MULTIPLE DIVIDED BY THE PLY TURNS PER INCH FOR COTTON 30/2 YARN

FIGURE 1



DISTRIBUTION OF THE RATIOS OF THE SQUARE OF THE
SINGLE TWIST MULTIPLE DIVIDED BY THE PLY
TURNS PER INCH FOR COTTON 30/2 YARN

FIGURE 2

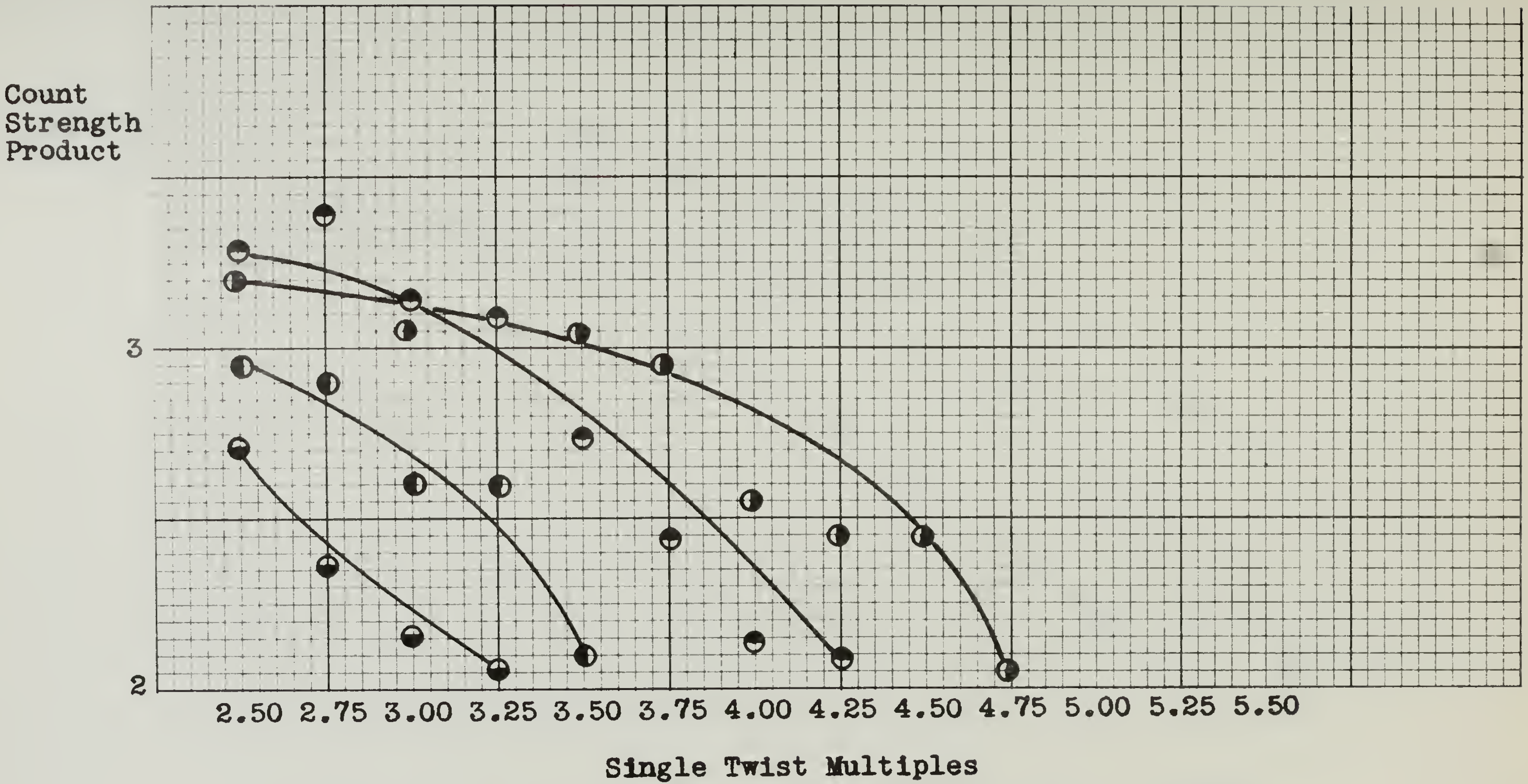


DISTRIBUTION OF THE RATIOS OF THE SQUARE OF THE SINGLE TWIST MULTIPLE DIVIDED BY THE PLY TURNS PER INCH FOR COTTON 30/2 YARN

Legend

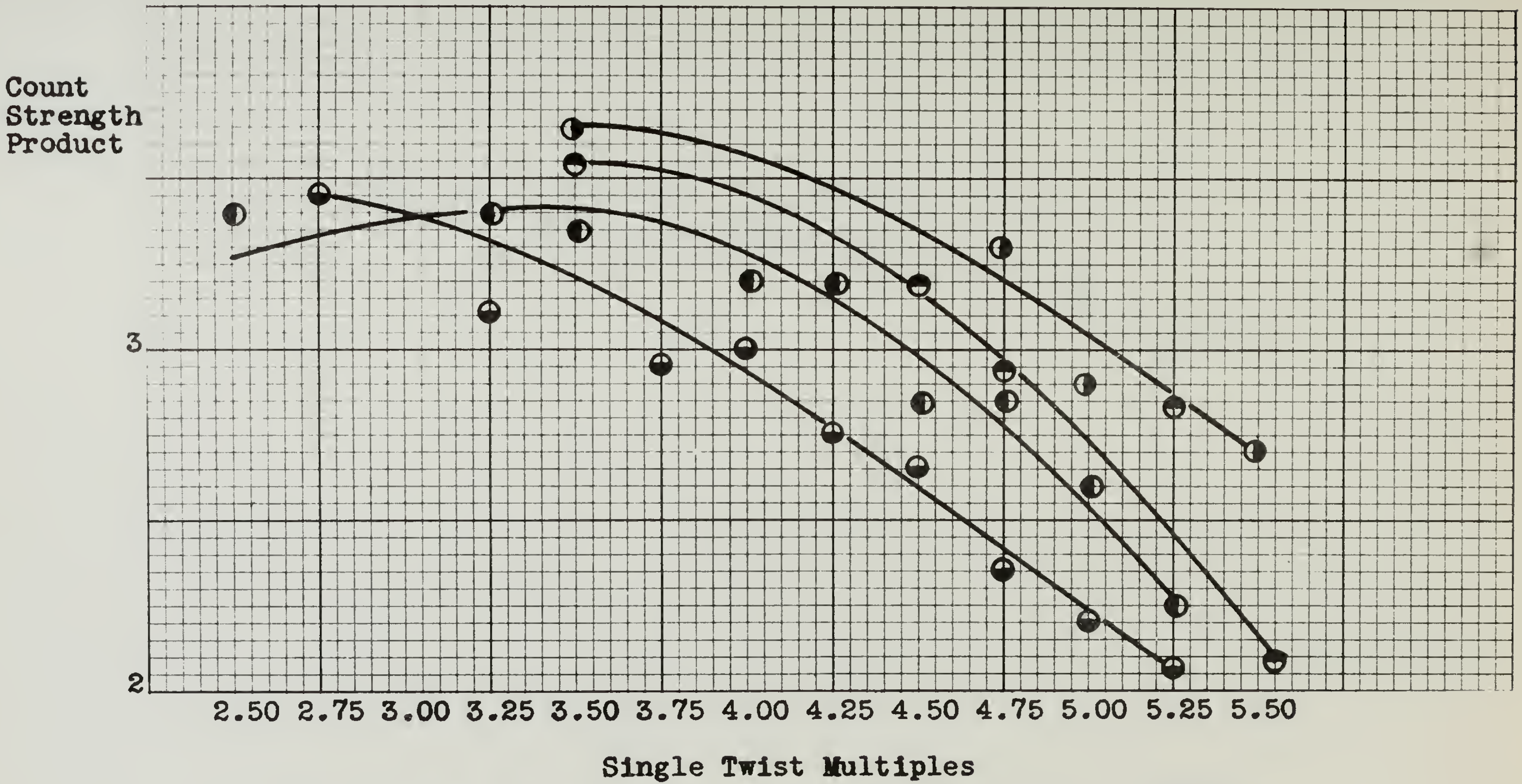
1.00-1.20 ◐
.90-1.00 ◒

FIGURE 3



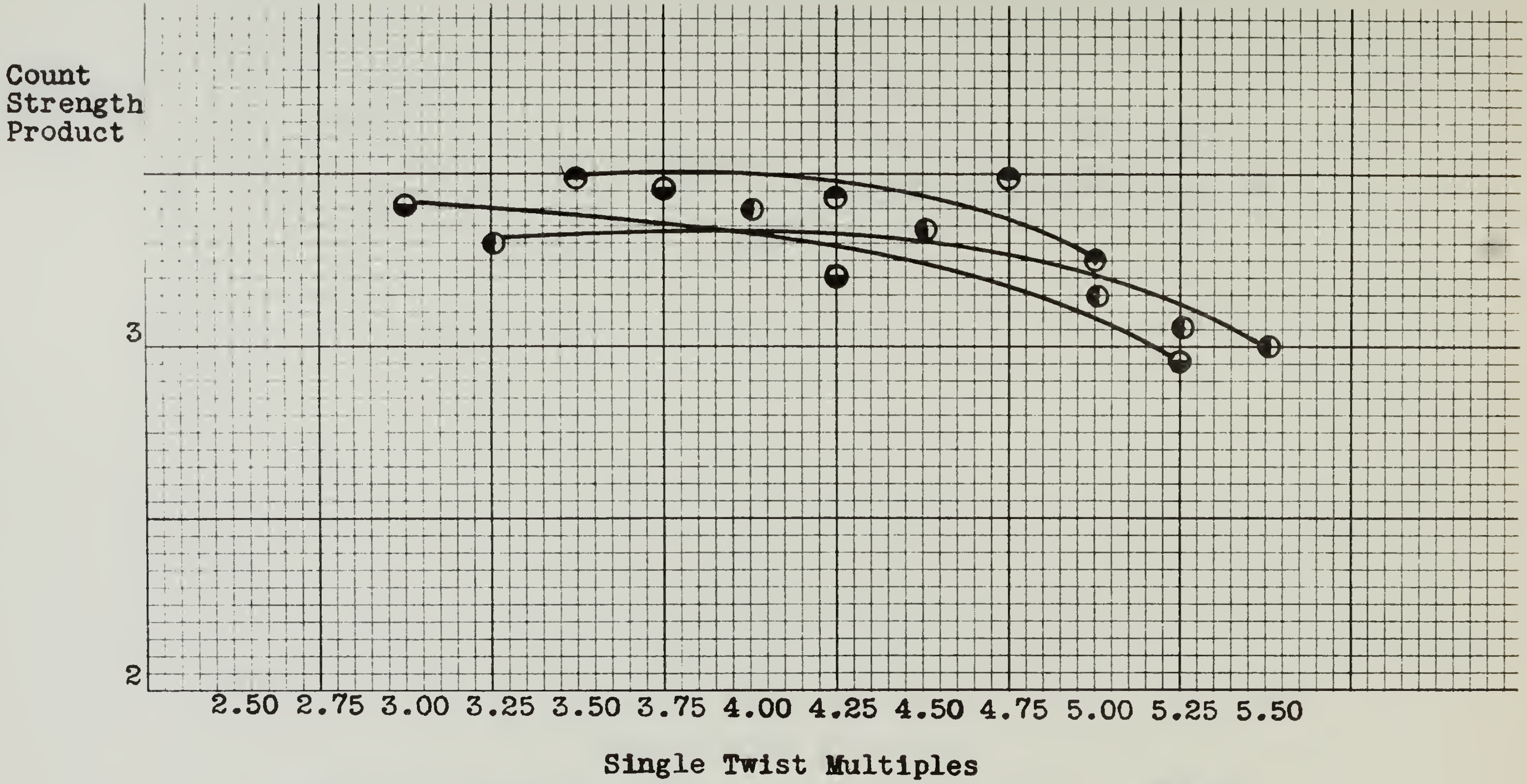
DISTRIBUTION OF THE RATIOS OF THE SQUARE OF THE SINGLE TWIST MULTIPLE DIVIDED BY THE PLY TURNS PER INCH FOR NYLON 30/2 STAPLE YARN

FIGURE 4



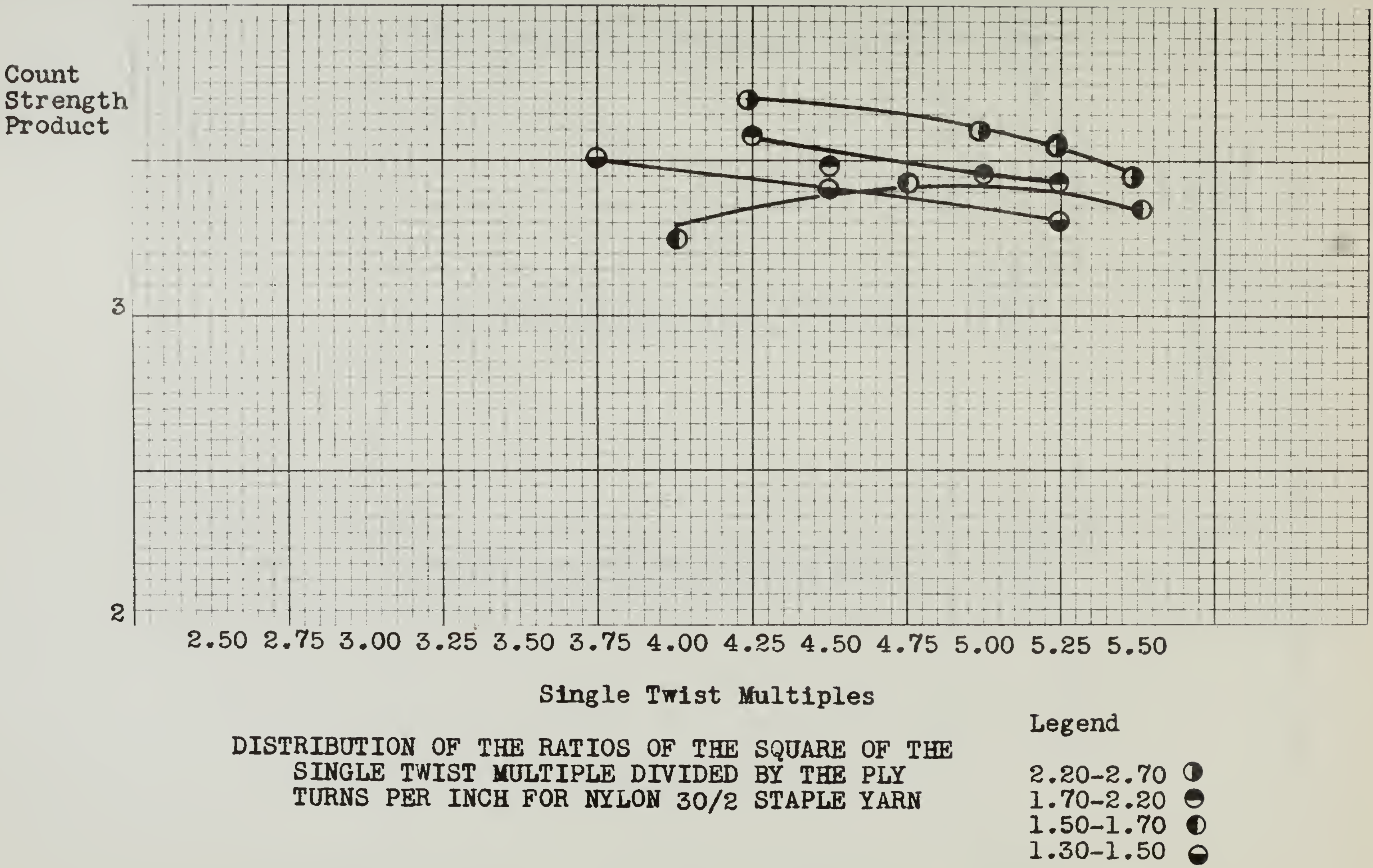
DISTRIBUTION OF THE RATIOS OF THE SQUARE OF THE SINGLE TWIST MULTIPLE DIVIDED BY THE PLY TURNS PER INCH FOR NYLON 30/2 STAPLE YARN

FIGURE 5



DISTRIBUTION OF THE RATIOS OF THE SQUARE OF THE SINGLE TWIST MULTIPLE DIVIDED BY THE PLY TURNS PER INCH FOR NYLON 30/2 STAPLE YARN

FIGURE 6



DISTRIBUTION OF THE RATIOS OF THE SQUARE OF THE SINGLE TWIST MULTIPLE DIVIDED BY THE PLY TURNS PER INCH FOR NYLON 30/2 STAPLE YARN

FIGURE 7

Table 17. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.85s
Single T.M. - 2.50
Twist per Inch in the Ply - 10.3
Ratio - .61

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.50	21.	1.38
2.	1.40	22.	1.45
3.	1.44	23.	1.41
4.	1.53	24.	1.43
5.	1.41	25.	1.34
6.	1.62	26.	1.45
7.	1.59	27.	1.42
8.	1.56	28.	1.55
9.	1.72	29.	1.40
10.	1.57	30.	1.53
11.	1.65	31.	1.56
12.	1.59	32.	1.60
13.	1.48	33.	1.50
14.	1.59	34.	1.52
15.	1.48	35.	1.68
16.	1.54	36.	1.78
17.	1.42	37.	1.65
18.	1.49	38.	1.63
19.	1.53	39.	1.56
20.	1.35	40.	1.58

Total 60.80

Average 1.52

Table 18. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.20s
Single T.M. - 2.50
Twist per Inch in the Ply - 12.5
Ratio - .50

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.60	21.	1.90
2.	1.50	22.	1.92
3.	1.50	23.	1.90
4.	1.50	24.	1.95
5.	1.60	25.	1.90
6.	1.58	26.	1.94
7.	1.65	27.	1.92
8.	1.68	28.	1.88
9.	1.67	29.	1.78
10.	1.73	30.	1.70
11.	1.58	31.	1.72
12.	1.78	32.	1.92
13.	1.48	33.	1.80
14.	1.78	34.	1.80
15.	1.88	35.	1.84
16.	1.74	36.	1.82
17.	1.68	37.	1.84
18.	1.82	38.	1.94
19.	1.90	39.	1.86
20.	1.84	40.	1.88

Total 70.70

Average 1.77

Table 19. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.25s
Single T.M. - 2.50
Twist per Inch in the Ply - 17.4
Ratio - .36

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.23	21.	1.90
2.	2.28	22.	1.94
3.	2.06	23.	2.10
4.	1.92	24.	2.12
5.	2.06	25.	1.83
6.	1.93	26.	1.85
7.	1.75	27.	1.85
8.	1.85	28.	2.00
9.	2.12	29.	1.70
10.	1.90	30.	1.75
11.	2.14	31.	1.73
12.	1.90	32.	1.87
13.	1.95	33.	1.98
14.	1.78	34.	1.84
15.	1.91	35.	2.02
16.	2.02	36.	1.63
17.	1.70	37.	1.87
18.	1.73	38.	1.80
19.	1.73	39	1.74
20.	1.87	40.	1.77

Total 77.12

Average 1.93

Table 20. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.85s
Single T.M. - 2.50
Twist per Inch in the Ply - 19.7
Ratio - .32

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.15	21.	2.20
2.	2.07	22.	2.00
3.	2.15	23.	2.12
4.	2.25	24.	2.25
5.	2.05	25.	2.30
6.	2.05	26.	2.15
7.	2.50	27.	2.25
8.	2.20	28.	2.25
9.	2.05	29.	2.01
10.	2.15	30.	2.15
11.	2.05	31.	2.05
12.	1.90	32.	2.50
13.	2.00	33.	1.95
14.	2.40	34.	2.39
15.	1.95	35.	2.10
16.	2.35	36.	2.25
17.	1.90	37.	2.12
18.	2.10	38.	2.22
19.	2.10	39.	2.35
20.	2.08	40.	2.05
		Total	86.11
		Average	2.15

Table 21. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.25s
Single T.M. - 2.50
Twist per Inch in the Ply - 23.2
Ratio - .27

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.55	21.	2.03
2.	1.93	22.	2.24
3.	1.97	23.	2.13
4.	1.92	24.	1.68
5.	1.90	25.	1.83
6.	2.01	26.	1.60
7.	1.90	27.	1.84
8.	2.03	28.	1.85
9.	2.22	29.	2.03
10.	2.14	30.	1.84
11.	2.17	31.	2.14
12.	1.83	32.	2.23
13.	1.89	33.	1.80
14.	1.88	34.	2.15
15.	1.93	35.	1.83
16.	1.98	36.	2.10
17.	1.84	37.	2.08
18.	1.66	38.	2.10
19.	1.63	39.	2.02
20.	1.50	40.	2.16
		Total	77.56
		Average	1.94

Table 22. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.80s
Single T.M. - 2.50
Twist per Inch in the Ply - 26.8
Ratio - .23

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.42	21.	2.08
2.	2.75	22.	2.10
3.	2.55	23.	1.80
4.	2.30	24.	2.15
5.	2.65	25.	2.05
6.	2.40	26.	2.25
7.	2.22	27.	2.25
8.	2.22	28.	2.15
9.	2.20	29.	2.15
10.	2.00	30.	2.35
11.	2.15	31.	2.05
12.	2.25	32.	2.24
13.	2.35	33.	2.15
14.	2.25	34.	2.25
15.	2.25	35.	2.08
16.	2.15	36.	1.80
17.	2.00	37.	1.97
18.	2.15	38.	2.04
19.	2.25	39.	2.34
20.	2.15	40.	2.10

Total 88.01

Average 2.20

Table 23. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.10s
Single T.M. - 2.50
Twist per Inch in the Ply - 29.1
Ratio - .22

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.49	21.	1.94
2.	2.11	22.	1.97
3.	2.24	23.	2.15
4.	2.39	24.	2.17
5.	2.00	25.	1.80
6.	2.34	26.	2.13
7.	2.24	27.	1.94
8.	2.15	28.	2.24
9.	2.13	29.	2.37
10.	2.10	30.	2.12
11.	1.98	31.	1.94
12.	2.20	32.	1.99
13.	2.25	33.	2.00
14.	1.95	34.	2.00
15.	1.97	35.	2.28
16.	2.23	36.	2.23
17.	2.29	37.	2.80
18.	2.34	38.	2.80
19.	2.48	39.	2.30
20.	2.28	40.	2.50

Total 87.83

Average 2.19

Table 24. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.50s
Single T.M. - 2.50
Twist per Inch in the Ply - 39.6
Ratio - .16

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.96	21.	2.07
2.	1.79	22.	1.86
3.	1.68	23.	1.77
4.	2.00	24.	2.00
5.	1.84	25.	1.83
6.	1.87	26.	1.89
7.	2.14	27.	1.66
8.	2.02	28.	1.84
9.	1.97	29.	2.11
10.	2.03	30.	1.94
11.	2.00	31.	2.03
12.	1.84	32.	1.98
13.	2.11	33.	1.69
14.	1.83	34.	1.92
15.	1.89	35.	1.88
16.	1.62	36.	1.64
17.	2.01	37.	1.93
18.	1.73	38.	1.84
19.	2.04	39.	2.14
20.	1.70	40.	1.95

Total 76.04

Average 1.90

Table 25. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.75s
Single T.M. - 2.75
Twist per Inch in the Ply - 10.3
Ratio - .73

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.42	21.	1.39
2.	1.46	22.	1.50
3.	1.54	23.	1.52
4.	1.38	24.	1.62
5.	1.52	25.	1.40
6.	1.52	26.	1.44
7.	1.52	27.	1.58
8.	1.32	28.	1.34
9.	1.60	29.	1.50
10.	1.54	30.	1.52
11.	1.38	31.	1.32
12.	1.50	32.	1.38
13.	1.62	33.	1.44
14.	1.58	34.	1.58
15.	1.60	35.	1.58
16.	1.52	36.	1.46
17.	1.55	37.	1.50
18.	1.48	38.	1.52
19.	1.60	39.	1.42
20.	1.60	40.	1.38

Total 59.74

Average 1.49

Table 26. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.10s
Single T.M. - 2.75
Twist per Inch in the Ply - 17.6
Ratio - .43

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.92	21.	2.02
2.	2.02	22.	1.80
3.	1.94	23.	2.04
4.	2.00	24.	1.94
5.	2.00	25.	2.06
6.	1.98	26.	1.97
7.	1.82	27.	2.08
8.	1.96	28.	1.78
9.	1.78	29.	1.80
10.	1.86	30.	1.94
11.	1.88	31.	1.86
12.	1.97	32.	2.05
13.	2.02	33.	2.06
14.	1.94	34.	1.95
15.	2.08	35.	2.00
16.	1.84	36.	1.75
17.	2.02	37.	1.94
18.	2.08	38.	1.86
19.	1.88	39.	2.00
20.	2.04	40.	1.96

Total	78.89
Average	1.97

Table 27. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.85s
Single T.M. - 2.75
Twist per Inch in the Ply - 23.2
Ratio - .33

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.18	21.	2.25
2.	2.19	22.	2.17
3.	2.50	23.	2.19
4.	2.05	24.	2.35
5.	2.25	25.	2.30
6.	2.50	26.	2.65
7.	2.35	27.	2.35
8.	2.05	28.	2.35
9.	2.40	29.	2.42
10.	2.25	30.	2.10
11.	2.25	31.	2.36
12.	2.75	32.	2.28
13.	2.75	33.	2.55
14.	2.55	34.	2.25
15.	2.35	35.	2.15
16.	2.40	36.	2.30
17.	2.35	37.	2.52
18.	2.65	38.	2.65
19.	2.25	39.	2.20
20.	2.40	40.	2.48
		Total	94.29
		Average	2.35

Table 28. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.00s
Single T.M. - 2.75
Twist per Inch in the Ply - 28.5
Ratio - .26

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.00	21.	1.98
2.	2.00	22.	2.14
3.	2.15	23.	2.25
4.	2.00	24.	2.06
5.	2.25	25.	2.05
6.	2.30	26.	2.10
7.	2.08	27.	2.25
8.	2.14	28.	2.02
9.	2.10	29.	1.99
10.	2.18	30.	2.10
11.	2.30	31.	2.18
12.	2.30	32.	2.10
13.	2.25	33.	2.25
14.	2.02	34.	1.90
15.	2.18	35.	1.96
16.	1.98	36.	2.04
17.	2.25	37.	2.22
18.	1.95	38.	2.08
19.	2.45	39.	1.98
20.	2.30	40.	2.25

Total 85.08

Average 2.12

Table 29. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.85s
Single T.M. - 2.75
Twist per Inch in the Ply - 39.4
Ratio - .19

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.86	21.	1.96
2.	2.04	22.	1.92
3.	2.12	23.	2.00
4.	2.15	24.	1.87
5.	2.12	25.	2.10
6.	2.00	26.	2.12
7.	2.12	27.	2.04
8.	2.15	28.	1.98
9.	2.02	29.	2.03
10.	1.92	30.	2.00
11.	2.06	31.	1.84
12.	2.05	32.	1.95
13.	2.12	33.	2.12
14.	1.88	34.	2.04
15.	2.10	35.	2.18
16.	2.06	36.	1.84
17.	2.04	37.	1.89
18.	1.86	38.	2.14
19.	1.92	39.	2.00
20.	2.00	40.	1.98

Total 80.59

Average 2.01

Table 30. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.40s
Single T.M. - 3.00
Twist per Inch in the Ply - 10.3
Ratio - .87

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.66	21.	1.64
2.	1.62	22.	1.58
3.	1.60	23.	1.48
4.	1.62	24.	1.60
5.	1.62	25.	1.62
6.	1.64	26.	1.64
7.	1.45	27.	1.56
8.	1.62	28.	1.60
9.	1.64	29.	1.54
10.	1.60	30.	1.65
11.	1.60	31.	1.48
12.	1.48	32.	1.56
13.	1.58	33.	1.45
14.	1.60	34.	1.68
15.	1.50	35.	1.62
16.	1.48	36.	1.49
17.	1.60	37.	1.56
18.	1.48	38.	1.64
19.	1.44	39.	1.52
20.	1.58	40.	1.60

Total 62.92

Average 1.57

Table 31. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.70s
Single T.M. - 3.00
Twist per Inch in the Ply - 14.7
Ratio - .61

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.68	21.	1.84
2.	1.52	22.	1.97
3.	1.86	23.	2.02
4.	1.74	24.	1.98
5.	2.02	25.	1.72
6.	1.85	26.	1.89
7.	1.82	27.	1.80
8.	1.86	28.	1.85
9.	1.82	29.	1.94
10.	1.90	30.	2.04
11.	1.80	31.	1.92
12.	1.70	32.	1.85
13.	1.92	33.	1.84
14.	1.96	34.	1.72
15.	2.00	35.	1.58
16.	2.05	36.	1.65
17.	1.98	37.	2.08
18.	2.05	38.	1.87
19.	1.88	39.	2.02
20.	1.96	40.	1.80

Total 74.75

Average 1.86

Table 32. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.60s
Single T.M. - 3.00
Twist per Inch in the Ply - 20.0
Ratio - .45

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.15	21.	2.44
2.	2.15	22.	2.28
3.	2.30	23.	2.30
4.	2.32	24.	1.88
5.	2.36	25.	1.94
6.	2.40	26.	2.22
7.	2.20	27.	2.45
8.	2.34	28.	2.15
9.	2.05	29.	2.28
10.	1.90	30.	2.30
11.	2.40	31.	2.20
12.	2.24	32.	1.90
13.	2.47	33.	2.08
14.	2.45	34.	2.05
15.	2.24	35.	2.25
16.	2.05	36.	2.01
17.	2.47	37.	1.96
18.	2.25	38.	2.01
19.	2.01	39.	1.92
20.	1.94	40.	2.18

Total 87.49

Average 2.18

Table 33. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.40s
Single T.M. - 3.00
Twist per Inch in the Ply - 26.6
Ratio - .33

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.15	21.	2.47
2.	2.00	22.	2.20
3.	2.33	23.	2.03
4.	2.20	24.	2.24
5.	1.95	25.	2.33
6.	2.13	26.	2.27
7.	2.03	27.	2.38
8.	2.47	28.	2.45
9.	2.48	29.	2.18
10.	2.32	30.	2.42
11.	2.30	31.	2.27
12.	2.24	32.	2.30
13.	2.27	33.	2.28
14.	2.25	34.	1.92
15.	2.49	35.	2.00
16.	2.32	36.	1.98
17.	2.47	37.	2.03
18.	2.24	38.	1.95
19.	2.32	39.	2.08
20.	2.15	40.	2.32

Total 89.21

Average 2.23

Table 34. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.00s
Single T.M. - 3.00
Twist per Inch in the Ply - 34.1
Ratio - .26

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.42	21.	1.94
2.	2.42	22.	1.78
3.	2.25	23.	2.26
4.	2.24	24.	2.38
5.	2.00	25.	2.25
6.	2.15	26.	2.00
7.	2.15	27.	2.15
8.	2.10	28.	2.28
9.	2.10	29.	2.10
10.	2.17	30.	1.88
11.	2.34	31.	2.05
12.	2.27	32.	1.86
13.	2.23	33.	2.15
14.	2.15	34.	2.15
15.	2.45	35.	2.20
16.	2.15	36.	2.04
17.	2.10	37.	2.10
18.	1.90	38.	2.16
19.	1.77	39.	2.18
20.	2.18	40.	2.23

Total 85.68

Average 2.14

Table 35. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.05s
Single T.M. - 3.00
Twist per Inch in the Ply - 40.2
Ratio - .22

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.00	21.	1.95
2.	2.15	22.	2.10
3.	1.90	23.	1.85
4.	2.14	24.	2.00
5.	2.00	25.	2.15
6.	2.02	26.	2.05
7.	2.02	27.	1.90
8.	1.75	28.	2.00
9.	1.93	29.	1.80
10.	1.96	30.	1.90
11.	2.03	31.	1.90
12.	1.90	32.	2.10
13.	2.05	33.	2.15
14.	1.85	34.	2.00
15.	2.08	35.	1.96
16.	2.05	36.	1.84
17.	1.96	37.	2.08
18.	2.25	38.	2.15
19.	1.92	39.	1.80
20.	2.02	40.	1.95

Total 79.53

Average 1.99

Table 36. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.70s
Single T.M. - 3.25
Twist per Inch in the Ply - 10.1
Ratio - 1.06

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.96	21.	1.88
2.	1.80	22.	1.82
3.	1.75	23.	1.64
4.	1.88	24.	1.75
5.	1.82	25.	1.94
6.	1.92	26.	1.80
7.	1.74	27.	1.90
8.	1.82	28.	1.82
9.	1.88	29.	1.78
10.	1.78	30.	1.88
11.	1.78	31.	1.74
12.	1.80	32.	1.86
13.	1.88	33.	1.95
14.	1.68	34.	1.80
15.	1.75	35.	1.92
16.	1.84	36.	1.83
17.	1.78	37.	1.70
18.	1.66	38.	1.88
19.	1.86	39.	1.93
20.	1.78	40.	1.87
		Total	72.85
		Average	1.82

Table 37. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.40s
Single T.M. - 3.25
Twist per Inch in the Ply - 14.8
Ratio - .71

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.05	21.	1.78
2.	1.94	22.	1.92
3.	1.86	23.	1.72
4.	1.92	24.	1.87
5.	1.86	25.	1.84
6.	1.78	26.	1.90
7.	1.80	27.	1.78
8.	1.76	28	2.00
9.	1.96	29.	1.87
10.	1.98	30.	1.92
11.	1.94	31.	1.85
12.	1.96	32.	1.95
13.	1.86	33.	2.02
14.	1.92	34.	1.80
15.	1.66	35.	1.84
16.	1.84	36.	1.92
17.	1.83	37.	1.90
18.	1.74	38.	1.78
19.	1.78	39.	1.95
20.	1.95	40.	1.90

Total 74.90

Average 1.87

Table 38. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.70s
Single T.M. - 3.25
Twist per Inch in the Ply - 19.7
Ratio - .53

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.05	21.	2.25
2.	2.35	22.	2.30
3.	2.30	23.	2.05
4.	2.30	24.	2.05
5.	2.15	25.	2.25
6.	2.20	26.	2.45
7.	2.30	27.	2.00
8.	2.05	28.	2.30
9.	2.20	29.	2.20
10.	2.40	30.	2.15
11.	2.10	31.	2.20
12.	2.10	32.	2.38
13.	2.40	33.	2.15
14.	2.10	34.	2.30
15.	2.20	35.	2.30
16.	2.30	36.	2.00
17.	2.05	37.	2.10
18.	2.15	38.	2.30
19.	2.20	39.	2.00
20.	2.25	40.	2.40
		Total	88.28
		Average	2.20

Table 39. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.35s
Single T.M. - 3.25
Twist per Inch in the Ply - 26.5
Ratio - .40

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.60	21.	2.30
2.	2.25	22.	2.45
3.	2.10	23.	2.10
4.	2.30	24.	2.50
5.	2.15	25.	2.20
6.	2.20	26.	2.25
7.	2.40	27.	2.30
8.	2.30	28.	2.35
9.	2.30	29.	2.10
10.	2.25	30.	2.40
11.	2.20	31.	2.35
12.	2.05	32.	2.20
13.	2.50	33.	2.15
14.	2.30	34.	2.45
15.	2.20	35.	2.30
16.	2.15	36.	2.30
17.	2.25	37.	2.30
18.	2.15	38.	2.45
19.	2.25	39.	2.20
20.	2.30	40.	2.15

Total	91.00
Average	2.27

Table 40. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.70s
Single T.M. - 3.25
Twist per Inch in the Ply - 33.3
Ratio - .32

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.20	21.	2.12
2.	2.55	22.	2.40
3.	2.20	23.	2.15
4.	2.20	24.	2.04
5.	2.60	25.	2.38
6.	2.53	26.	2.50
7.	2.24	27.	2.10
8.	2.10	28.	2.20
9.	2.23	29.	2.05
10.	2.15	30.	2.30
11.	2.25	31.	2.25
12.	2.05	32.	2.25
13.	2.15	33.	2.15
14.	2.37	34.	2.30
15.	2.03	35.	2.25
16.	2.53	36.	2.20
17.	2.50	37.	2.10
18.	2.05	38.	2.35
19.	2.04	39.	2.28
20.	2.32	40.	2.05
		Total	89.71
		Average	2.24

Table 41. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.60s
Single T.M. - 3.25
Twist per Inch in the Ply - 40.1
Ratio - .26

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.40	21.	2.30
2.	2.30	22.	2.25
3.	2.42	23.	2.45
4.	2.30	24.	2.40
5.	2.40	25.	2.55
6.	2.32	26.	2.30
7.	2.35	27.	2.15
8.	2.30	28.	2.40
9.	2.00	29.	2.35
10.	2.34	30.	2.55
11.	2.35	31.	2.30
12.	2.35	32.	2.10
13.	2.30	33.	2.20
14.	2.15	34.	2.40
15	2.50	35.	2.15
16.	2.15	36.	2.20
17.	2.05	37.	2.25
18.	2.60	38.	2.50
19.	2.24	39.	2.45
20.	2.35	40.	2.30

Total 92.72

Average 2.32

Table 42. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.27s
Single T.M. - 3.50
Twist per Inch in the Ply - 19.9
Ratio - .62

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.98	21.	1.94
2.	1.91	22.	2.00
3.	2.02	23.	1.75
4.	1.92	24.	1.78
5.	1.87	25.	1.96
6.	1.76	26.	1.85
7.	1.80	27.	1.89
8.	1.80	28.	1.94
9.	1.84	29.	1.97
10.	2.00	30.	2.04
11.	2.05	31.	2.00
12.	1.84	32.	1.75
13.	1.86	33.	1.86
14.	1.82	34.	1.96
15.	2.00	35.	2.00
16.	1.90	36.	1.94
17.	1.76	37.	1.85
18.	1.94	38.	1.92
19.	1.90	39.	1.97
20.	1.78	40.	2.02
		Total	76.14
		Average	1.903

Table 43. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count 15.62s
Single T.M. - 3.50
Twist per Inch in the Ply - 25.8
Ratio - .47

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.90	21.	1.92
2.	2.02	22.	2.00
3.	2.15	23.	2.10
4.	2.20	24.	2.25
5.	2.15	25.	1.98
6.	2.20	26.	2.00
7.	2.10	27.	1.98
8.	2.10	28.	2.00
9.	2.30	29.	2.25
10.	2.40	30.	2.30
11.	2.15	31.	2.30
12.	2.10	32.	2.15
13.	2.00	33.	2.00
14.	2.05	34.	2.35
15.	2.15	35.	1.75
16.	1.80	36.	1.84
17.	1.84	37.	1.93
18.	1.80	38.	2.10
19.	2.15	39.	2.04
20.	2.30	40.	2.40
		Total	83.50
		Average	2.09

Table 44. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.86s
Single T.M. - 3.50
Twist per Inch in the Ply - 34.7
Ratio - .35

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.50	21.	2.50
2.	2.30	22.	1.85
3.	2.15	23.	2.65
4.	2.25	24.	2.25
5.	2.15	25.	2.30
6.	2.15	26.	2.00
7.	2.00	27.	2.35
8.	2.25	28.	2.50
9.	2.50	29.	2.15
10.	2.50	30.	2.20
11.	2.54	31.	2.40
12.	2.65	32.	2.25
13.	2.54	33.	2.25
14.	2.50	34.	2.40
15.	2.20	35.	2.35
16.	2.15	36.	2.45
17.	2.30	37.	2.50
18.	2.25	38.	2.60
19.	2.05	39.	2.10
20.	1.90	40.	2.10

Total 91.98

Average 2.29

Table 45. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.50s
Single T. M. - 3.50
Twist per Inch in the Ply - 39.5
Ratio - .31

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.05	21.	2.35
2.	2.05	22.	2.00
3.	2.30	23.	2.46
4.	2.00	24.	2.40
5.	2.25	25.	2.20
6.	2.20	26.	2.25
7.	2.15	27.	2.15
8.	2.25	28.	2.40
9.	2.15	29.	2.05
10.	2.34	30.	2.25
11.	2.15	31.	2.10
12.	2.30	32.	2.50
13.	2.30	33.	2.15
14.	2.44	34.	2.60
15.	2.30	35.	2.15
16.	2.40	36.	2.20
17.	2.15	37.	2.20
18.	2.05	38.	2.25
19.	2.55	39.	2.10
20.	2.50	40.	2.35

Total	89.99
Average	2.25

Table 46. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.17s
Single T.M. - 3.50
Twist per Inch in the Ply - 49.7
Ratio - .25

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.90	21.	1.95
2.	1.75	22.	1.75
3.	1.80	23.	1.88
4.	1.76	24.	1.72
5.	1.77	25.	1.95
6.	1.75	26.	1.98
7.	1.80	27.	1.93
8.	1.88	28.	1.78
9.	1.95	29.	1.88
10.	2.00	30.	1.80
11.	1.78	31.	1.94
12.	1.80	32.	1.72
13.	1.72	33.	1.68
14.	2.10	34.	1.87
15.	1.90	35.	1.91
16.	1.70	36.	1.75
17.	1.75	37.	1.95
18.	1.86	38.	1.73
19.	1.95	39.	1.92
20.	1.75	40.	1.98

Total 73.74

Average 1.84

Table 47. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.27s
Single T.M. - 3.75
Twist per Inch in the Ply - 14.7
Ratio - .96

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.80	21.	2.04
2.	1.80	22.	1.92
3.	1.80	23.	1.90
4.	1.92	24.	1.80
5.	2.00	25.	1.96
6.	2.02	26.	2.02
7.	1.90	27.	1.94
8.	2.05	28.	1.82
9.	1.86	29.	1.82
10.	1.78	30.	2.00
11.	1.92	31.	1.95
12.	2.04	32.	1.90
13.	1.96	33.	1.80
14.	1.98	34.	1.78
15.	1.92	35.	2.10
16.	1.94	36.	2.04
17.	2.00	37.	1.96
18.	1.96	38.	1.84
19.	1.82	39.	2.00
20.	1.92	40.	1.90
		Total	76.88
		Average	1.92

Table 48. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.51s
Single T.M. - 3.75
Twist per Inch in the Ply - 19.5
Ratio - .70

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.15	21.	2.35
2.	2.30	22.	2.05
3.	2.50	23.	2.30
4.	2.05	24.	2.20
5.	2.15	25.	2.40
6.	2.30	26.	2.45
7.	2.20	27.	2.20
8.	2.25	28.	2.40
9.	2.20	29.	2.10
10.	2.30	30.	2.25
11.	2.40	31.	2.30
12.	2.25	32.	2.45
13.	2.30	33.	2.20
14.	2.40	34.	2.50
15.	2.30	35.	2.35
16.	2.20	36.	2.60
17.	2.40	37.	2.30
18.	2.40	38.	2.40
19.	2.30	39.	2.15
20.	2.50	40.	2.05

Total 91.85

Average 2.29

Table 49. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.00s
Single T.M. - 3.75
Twist per Inch in the Ply - 26.3
Ratio - .54

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.30	21.	2.40
2.	2.20	22.	2.45
3.	2.40	23.	2.60
4.	2.40	24.	2.30
5.	2.30	25.	2.45
6.	2.30	26.	2.70
7.	2.20	27.	2.25
8.	2.50	28.	2.20
9.	2.75	29.	2.60
10.	2.30	30.	2.80
11.	2.30	31.	2.25
12.	2.50	32.	2.30
13.	2.50	33.	2.40
14.	2.30	34.	2.40
15.	2.30	35.	2.35
16.	2.50	36.	2.55
17.	2.20	37.	2.20
18.	2.55	38.	2.50
19.	2.30	39.	2.60
20.	2.40	40.	2.40
		Total	96.20
		Average	2.40

Table 50. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.94s
Single T.M. - 3.75
Twist per Inch in the Ply - 32.2
Ratio - .44

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.15	21.	2.65
2.	2.15	22.	2.00
3.	2.30	23.	2.20
4.	2.00	24.	2.40
5.	2.30	25.	2.15
6.	2.20	26.	2.05
7.	2.00	27.	2.50
8.	2.00	28.	2.00
9.	2.05	29.	2.15
10.	2.30	30.	2.35
11.	2.40	31.	2.40
12.	2.25	32.	2.10
13.	2.50	33.	2.50
14.	2.30	34.	2.05
15.	2.30	35.	2.55
16.	2.25	36.	2.15
17.	2.60	37.	2.30
18.	2.50	38.	2.40
19.	2.30	39.	2.20
20.	2.05	40.	2.00
		Total	90.00
		Average	2.25

Table 51. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.32s
Single T.M. - 3.75
Twist per Inch in the Ply - 38.0
Ratio - .37

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.30	21.	1.90
2.	2.25	22.	2.25
3.	2.30	23.	2.00
4.	2.25	24.	1.90
5.	2.25	25.	1.80
6.	2.00	26.	2.30
7.	2.15	27.	2.00
8.	2.20	28.	2.15
9.	2.30	29.	2.15
10.	2.15	30.	2.35
11.	1.90	31.	2.20
12.	2.05	32.	2.40
13.	1.80	33.	1.80
14.	2.00	34.	2.00
15.	2.20	35.	2.20
16.	2.10	36.	2.35
17.	2.00	37.	2.10
18.	2.25	38.	2.40
19.	2.35	39.	2.25
20.	2.00	40.	2.30
		Total	85.60
		Average	2.14

Table 52. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.15s
Single T.M. - 3.75
Twist per Inch in the Ply - 47.0
Ratio - .30

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.90	21.	1.80
2.	1.84	22.	1.74
3.	1.72	23.	2.00
4.	2.02	24.	1.88
5.	1.82	25.	1.82
6.	1.66	26.	1.70
7.	1.88	27.	2.08
8.	2.10	28.	1.78
9.	2.04	29.	1.84
10.	1.84	30.	2.00
11.	1.78	31.	1.92
12.	1.78	32.	1.90
13.	1.88	33.	1.82
14.	1.98	34.	2.04
15.	1.88	35.	1.80
16.	1.94	36.	1.95
17.	1.83	37.	1.92
18.	2.02	38.	1.72
19.	1.96	39.	1.83
20.	1.76	40.	1.97
		Total	75.14
		Average	1.88

Table 53. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.68s
Single T.M. - 4.00
Twist per Inch in the Ply - 20.7
Ratio - .80

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.05	21.	1.92
2.	1.96	22.	2.00
3.	2.00	23.	1.78
4.	2.04	24.	1.92
5.	2.04	25.	1.84
6.	2.08	26.	1.86
7.	2.04	27.	2.02
8.	2.00	28.	2.10
9.	1.86	29.	2.00
10.	2.04	30.	1.90
11.	1.70	31.	1.74
12.	2.15	32.	1.88
13.	2.10	33.	2.00
14.	2.00	34.	1.98
15.	1.90	35.	1.78
16.	2.00	36.	2.06
17.	2.00	37.	2.02
18.	1.90	38.	1.70
19.	1.66	39.	1.90
20.	1.90	40.	1.70
		Total	77.52
		Average	1.93

Table 54. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.49s
Single T.M. - 4.00
Twist per Inch in the Ply - 26.5
Ratio - .60

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.18	21.	2.10
2.	2.14	22.	2.05
3.	2.20	23.	2.30
4.	2.05	24.	1.90
5.	2.15	25.	1.95
6.	2.25	26.	2.30
7.	2.15	27.	2.00
8.	2.00	28.	2.20
9.	2.25	29.	2.18
10.	2.25	30.	2.15
11.	2.20	31.	2.04
12.	1.90	32.	1.75
13.	2.35	33.	2.15
14.	2.30	34.	2.10
15.	2.25	35.	2.40
16.	2.25	36.	2.25
17.	1.90	37.	2.20
18.	1.70	38.	2.08
19.	2.35	39.	2.15
20.	2.25	40.	2.15

Total 85.47

Average 2.13

Table 55. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.12s
Single T.M. - 4.00
Twist per Inch in the Ply - 32.2
Ratio - .50

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.05	21.	1.80
2.	2.25	22.	2.10
3.	2.10	23.	2.05
4.	2.25	24.	2.10
5.	2.05	25.	1.85
6.	2.10	26.	2.25
7.	2.15	27.	2.05
8.	1.80	28.	2.35
9.	2.25	29.	2.05
10.	2.35	30.	1.80
11.	1.90	31.	1.95
12.	2.25	32.	2.10
13.	2.15	33.	2.05
14.	2.05	34.	2.00
15.	2.15	35.	1.95
16.	2.00	36.	1.80
17.	2.05	37.	2.40
18.	2.00	38.	2.15
19.	2.30	39.	2.30
20.	2.05	40.	1.90

Total 85.25

Average 2.13

Table 56. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 12.00s
Single T.M. - 4.00
Twist per Inch in the Ply - 37.3
Ratio - .43

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.30	21.	2.50
2.	2.10	22.	2.00
3.	2.20	23.	2.65
4.	2.40	24.	2.20
5.	2.55	25.	2.70
6.	2.25	26.	2.40
7.	2.50	27.	2.55
8.	2.85	28.	2.70
9.	2.65	29.	2.35
10.	2.60	30.	2.20
11.	2.30	31.	2.40
12.	2.75	32.	2.15
13.	2.20	33.	2.80
14.	2.50	34.	2.65
15.	2.40	35.	2.35
16.	2.50	36.	2.60
17.	2.00	37.	2.30
18.	2.15	38.	2.55
19.	2.65	39.	2.10
20.	2.40	40.	2.50
		Total	96.90
		Average	2.42

Table 57. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.24s
Single T.M. - 4.00
Twist per Inch in the Ply - 47.0
Ratio - .33

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.95	21.	1.60
2.	1.80	22.	1.74
3.	1.65	23.	1.65
4.	2.04	24.	1.90
5.	1.74	25.	2.10
6.	1.96	26.	2.00
7.	2.04	27.	2.04
8.	1.78	28.	1.96
9.	1.68	29.	2.08
10.	1.76	30.	1.76
11.	2.10	31.	1.88
12.	2.00	32.	1.82
13.	1.75	33.	1.94
14.	1.86	34.	1.90
15.	2.00	35.	2.15
16.	1.82	36.	1.74
17.	2.08	37.	1.82
18.	1.94	38.	1.98
19.	1.95	39.	2.04
20.	1.82	40.	1.64
		Total	75.46
		Average	1.88

Table 58. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.24s
Single T.M. - 4.25
Twist per Inch in the Ply - 19.7
Ratio - .90

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.05	21.	2.20
2.	2.15	22.	2.10
3.	1.80	23.	2.10
4.	2.40	24.	2.05
5.	2.05	25.	1.80
6.	2.20	26.	1.95
7.	1.90	27.	1.90
8.	1.80	28.	2.30
9.	2.30	29.	2.05
10.	1.95	30.	2.15
11.	2.60	31.	2.40
12.	2.05	32.	2.20
13.	2.15	33.	2.25
14.	1.90	34.	2.05
15.	1.90	35.	2.35
16.	1.90	36.	2.10
17.	1.80	37.	1.85
18.	1.85	38.	1.90
19.	1.80	39.	2.40
20.	1.80	40.	2.35

Total	82.80
Average	2.07

Table 59. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.26s
Single T.M. - 4.25
Twist per Inch in the Ply - 26.2
Ratio - .69

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.10	21.	1.85
2.	2.10	22.	1.80
3.	2.15	23.	2.25
4.	2.15	24.	2.30
5.	2.05	25.	2.05
6.	2.05	26.	2.15
7.	2.30	27.	1.75
8.	2.30	28.	1.70
9.	2.15	29.	2.00
10.	2.15	30.	2.35
11.	2.25	31.	2.15
12.	2.15	32.	1.85
13.	1.80	33.	2.10
14.	1.90	34.	2.10
15.	1.70	35.	1.80
16.	1.71	36.	1.95
17.	2.10	37.	2.25
18.	2.25	38.	2.10
19.	1.90	39.	2.30
20.	2.15	40.	2.20
		Total	82.41
		Average	2.06

Table 60. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.84s
Single T.M. - 4.25
Twist per Inch in the Ply - 31.8
Ratio - .57

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.15	21.	2.25
2.	2.10	22.	2.10
3.	1.95	23.	2.20
4.	2.30	24.	2.05
5.	2.15	25.	2.35
6.	2.30	26.	1.85
7.	2.25	27.	2.00
8.	2.25	28.	2.10
9.	2.15	29.	2.25
10.	2.25	30.	2.15
11.	2.05	31.	1.95
12.	2.05	32.	1.90
13.	2.15	33.	1.90
14.	2.05	34.	2.30
15.	2.25	35.	2.10
16.	1.80	36.	2.15
17.	2.15	37.	2.25
18.	2.10	38.	2.35
19.	2.05	39.	2.05
20.	2.15	40.	2.15

Total 85.05

Average 2.126

Table 61. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.49s
Single T.M. - 4.25
Twist per Inch in the Ply - 37.2
Ratio - .48

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.25	21.	2.60
2.	2.25	22.	2.25
3.	2.15	23.	2.30
4.	2.25	24.	2.10
5.	2.30	25.	2.25
6.	2.30	26.	2.30
7.	2.25	27.	2.45
8.	2.40	28.	2.40
9.	2.75	29.	2.30
10.	2.25	30.	2.15
11.	2.15	31.	2.20
12.	2.50	32.	2.65
13.	2.20	33.	2.50
14.	2.30	34.	2.50
15.	2.40	35.	2.35
16.	2.30	36.	2.75
17.	2.25	37.	2.15
18.	2.50	38.	2.30
19.	2.35	39.	2.25
20.	2.70	40.	2.35
		Total	93.90
		Average	2.34

Table 62. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 11.53s
Single T.M. - 4.25
Twist per Inch in the Ply - 46.2
Ratio - .39

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.90	21.	1.88
2.	1.80	22.	2.08
3.	2.05	23.	1.70
4.	1.60	24.	2.15
5.	1.90	25.	2.25
6.	2.05	26.	2.12
7.	2.05	27.	2.05
8.	1.80	28.	2.08
9.	1.80	29.	2.00
10.	2.20	30.	1.73
11.	1.95	31.	2.10
12.	2.05	32.	1.80
13.	2.15	33.	2.18
14.	2.15	34.	2.10
15.	2.25	35.	2.05
16.	2.25	36.	2.08
17.	1.90	37.	1.78
18.	2.15	38.	1.95
19.	2.10	39.	1.95
20.	2.25	40.	1.85

Total 80.23

Average 2.006

Table 63. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.73s
Single T.M. - 4.50
Twist per Inch in the Ply - 20.5
Ratio - .99

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.10	21.	2.15
2.	2.05	22.	2.40
3.	2.05	23.	2.40
4.	2.50	24.	1.85
5.	2.15	25.	2.00
6.	2.15	26.	1.95
7.	1.90	27.	1.80
8.	1.90	28.	2.30
9.	2.50	29.	2.20
10.	2.05	30.	2.15
11.	1.95	31.	2.15
12.	2.05	32.	2.30
13.	1.80	33.	2.45
14.	2.05	34.	1.85
15.	1.80	35.	1.90
16.	1.80	36.	2.05
17.	1.80	37.	2.05
18.	2.05	38.	1.90
19.	1.75	39.	1.70
20.	1.75	40.	1.95

Total 81.65

Average 2.04

Table 64. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.90s
Single T.M. - 4.50
Twist per Inch in the Ply - 26.1
Ratio - .78

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.05	21.	2.68
2.	1.92	22.	2.61
3.	2.08	23.	2.60
4.	2.01	24.	2.75
5.	2.08	25.	2.60
6.	2.02	26.	2.10
7.	2.12	27.	2.40
8.	2.20	28.	2.10
9.	2.30	29.	2.30
10.	2.40	30.	2.30
11.	2.40	31.	1.95
12.	2.20	32.	2.00
13.	2.35	33.	2.10
14.	2.50	34.	2.30
15.	2.10	35.	2.20
16.	2.25	36.	2.45
17.	2.25	37.	2.40
18.	2.60	38.	2.05
19.	2.20	39.	1.95
20.	2.40	40.	1.95
		Total	90.22
		Average	2.25

Table 65. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.96s
Single T.M. - 4.50
Twist per Inch in the Ply - 30.5
Ratio - .66

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.25	21.	2.07
2.	2.00	22.	1.80
3.	2.40	23.	1.80
4.	2.20	24.	2.25
5.	2.20	25.	2.10
6.	2.25	26.	2.35
7.	2.10	27.	2.25
8.	2.10	28.	1.80
9.	2.35	29.	2.45
10.	2.50	30.	2.30
11.	2.25	31.	2.30
12.	2.35	32.	1.95
13.	2.50	33.	2.00
14.	2.50	34.	1.90
15.	2.30	35.	2.20
16.	2.45	36.	2.10
17.	2.35	37.	2.30
18.	1.90	38.	2.25
19.	2.25	39.	2.05
20.	2.40	40.	2.55
		Total	88.37
		Average	2.21

Table 66. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.96s
Single T.M. - 4.50
Twist per Inch in the Ply - 36.5
Ratio - .55

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.00	21.	2.10
2.	2.15	22.	2.10
3.	2.15	23.	2.05
4.	2.15	24.	1.80
5.	2.25	25.	1.75
6.	2.10	26.	2.05
7.	2.15	27.	2.35
8.	2.30	28.	2.30
9.	2.00	29.	2.00
10.	2.05	30.	1.95
11.	2.00	31.	1.90
12.	2.15	32.	2.25
13.	2.05	33.	2.25
14.	1.80	34.	2.10
15.	2.10	35.	2.20
16.	1.90	36.	2.30
17.	1.95	37.	2.20
18.	2.15	38.	2.15
19.	1.95	39.	2.00
20.	2.05	40.	2.05
		Total	83.25
		Average	2.081

Table 67. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 12.04s
Single T.M. - 4.50
Twist per Inch in the Ply - 46.1
Ratio - .44

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.02	21.	1.98
2.	1.96	22.	2.00
3.	2.15	23.	1.86
4.	1.82	24.	1.94
5.	2.12	25.	1.92
6.	1.92	26.	2.10
7.	2.00	27.	2.00
8.	2.05	28.	2.05
9.	1.92	29.	1.96
10.	2.12	30.	2.20
11.	1.94	31.	2.18
12.	2.14	32.	1.90
13.	1.94	33.	1.98
14.	2.10	34.	2.00
15.	2.02	35.	2.10
16.	2.02	36.	1.96
17.	2.09	37.	1.74
18.	1.89	38.	2.12
19.	2.08	39.	2.10
20.	2.02	40.	1.92

Total 80.33

Average 2.01

Table 68. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.13s
Single T.M. - 4.75
Twist per Inch in the Ply - 19.8
Ratio - 1.14

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.88	21.	2.04
2.	1.96	22.	1.66
3.	2.04	23.	1.75
4.	1.96	24.	1.74
5.	1.96	25.	1.82
6.	1.84	26.	1.70
7.	1.84	27.	1.97
8.	1.86	28.	1.85
9.	2.10	29.	1.92
10.	1.78	30.	1.92
11.	1.72	31.	2.02
12.	1.68	32.	2.00
13.	2.04	33.	2.10
14.	2.00	34.	2.04
15.	1.92	35.	1.78
16.	1.84	36.	1.88
17.	2.01	37.	1.90
18.	2.05	38.	1.75
19.	2.15	39.	1.84
20.	2.01	40.	2.05
		Total	76.37
		Average	1.91

Table 69. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.40s
Single T.M. - 4.75
Twist per Inch in the Ply - 26.1
Ratio - .87

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.30	21.	2.05
2.	2.10	22.	1.90
3.	2.12	23.	1.95
4.	2.15	24.	2.30
5.	2.15	25.	2.25
6.	2.25	26.	2.10
7.	2.25	27.	2.40
8.	2.08	28.	2.45
9.	2.40	29.	2.25
10.	2.25	30.	2.00
11.	2.00	31.	1.85
12.	2.25	32.	1.90
13.	2.10	33.	2.20
14.	1.80	34.	2.10
15.	2.05	35.	2.30
16.	2.05	36.	2.35
17.	2.25	37.	2.20
18.	2.40	38.	2.40
19.	2.40	39.	2.15
20.	2.10	40.	2.10
		Total	86.60
		Average	2.16

Table 70. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.46s
Single T.M. - 4.75
Twist per Inch in the Ply - 31.8
Ratio - .71

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.35	21.	1.80
2.	2.05	22.	1.80
3.	2.15	23.	2.15
4.	2.30	24.	2.10
5.	2.15	25.	2.20
6.	1.90	26.	2.05
7.	1.95	27.	1.95
8.	2.15	28.	2.10
9.	2.10	29.	1.80
10.	2.05	30.	2.30
11.	1.90	31.	2.25
12.	1.90	32.	2.05
13.	1.90	33.	1.90
14.	2.10	34.	2.05
15.	2.00	35.	2.15
16.	2.00	36.	2.10
17.	2.15	37.	2.00
18.	1.85	38.	2.25
19.	2.00	39.	2.30
20.	2.25	40.	2.10
		Total	82.60
		Average	2.06

Table 71. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.85s
Single T.M. - 4.75
Twist per Inch in the Ply - 36.6
Ratio - .62

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.98	21.	2.04
2.	2.00	22.	2.00
3.	2.00	23.	2.06
4.	2.08	24.	2.10
5.	2.15	25.	2.02
6.	1.92	26.	1.95
7.	2.06	27.	2.18
8.	2.14	28.	2.00
9.	2.10	29.	2.04
10.	2.10	30.	2.14
11.	2.10	31.	1.98
12.	2.10	32.	2.02
13.	2.15	33.	2.08
14.	1.98	34.	2.00
15.	2.12	35.	1.96
16.	2.02	36.	2.04
17.	2.08	37.	2.12
18.	2.00	38.	2.08
19.	2.08	39.	2.08
20.	2.06	40.	2.16
		Total	82.27
		Average	2.056

Table 72. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.35s
Single T.M. - 4.75
Twist per Inch in the Ply - 46.7
Ratio - .48

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.02	21.	1.88
2.	1.88	22.	2.02
3.	1.90	23.	1.68
4.	2.02	24.	2.08
5.	1.76	25.	2.02
6.	1.76	26.	1.74
7.	1.92	27.	1.78
8.	2.10	28.	1.85
9.	1.98	29.	1.94
10.	2.02	30.	1.92
11.	2.00	31.	2.04
12.	2.05	32.	2.02
13.	1.70	33.	1.85
14.	1.80	34.	1.94
15.	1.80	35.	1.90
16.	1.90	36.	2.05
17.	1.86	37.	1.90
18.	2.08	38.	1.98
19.	1.60	39.	2.02
20.	1.94	40.	1.78
		Total	76.88
		Average	1.92

Table 73. Cotton 30/2 Yarn Single Strand Breaking Strengths

Count - 12.40s
Single T.M. - 4.75
Twist per Inch in the Ply - 54.3
Ratio - .42

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.66	21.	1.80
2.	1.84	22.	1.75
3.	1.66	23.	1.60
4.	1.42	24.	1.74
5.	1.76	25.	1.78
6.	1.56	26.	1.55
7.	1.60	27.	1.70
8.	1.64	28.	1.82
9.	1.68	29.	1.69
10.	1.76	30.	1.74
11.	1.80	31.	1.76
12.	1.78	32.	1.42
13.	1.50	33.	1.88
14.	1.40	34.	1.80
15.	1.56	35.	1.56
16.	1.50	36.	1.64
17.	1.72	37.	1.72
18.	1.92	38.	1.70
19.	1.70	39.	1.62
20.	1.62	40.	1.84
		Total	67.19
		Average	1.68

Table 74. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.79s
Single T.M. - 5.00
Twist per Inch in the Ply - 26.2
Ratio - .96

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.60	21.	2.04
2.	1.70	22.	1.98
3.	2.10	23.	1.96
4.	2.15	24.	1.74
5.	2.00	25.	2.08
6.	1.70	26.	2.16
7.	2.18	27.	1.87
8.	2.05	28.	1.66
9.	1.78	29.	1.89
10.	1.78	30.	2.02
11.	1.80	31.	2.02
12.	2.02	32.	2.12
13.	1.94	33.	1.75
14.	2.05	34.	1.94
15.	2.02	35.	2.18
16.	2.05	36.	2.10
17.	2.05	37.	2.04
18.	2.04	38.	2.02
19.	2.10	39.	1.78
20.	2.08	40.	2.02

Total 79.56

Average 1.99

Table 75. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.50s
Single T.M. - 5.00
Twist per Inch in the Ply - 31.5
Ratio - .79

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.00	21.	2.20
2.	1.80	22.	2.30
3.	2.08	23.	1.94
4.	2.12	24.	1.96
5.	2.18	25.	2.00
6.	2.00	26.	2.32
7.	2.10	27.	2.10
8.	2.06	28.	2.20
9.	2.15	29.	2.12
10.	2.50	30.	1.94
11.	2.10	31.	2.30
12.	2.40	32.	2.00
13.	2.00	33.	2.20
14.	1.80	34.	2.45
15.	2.20	35.	2.40
16.	2.30	36.	2.15
17.	2.40	37.	2.15
18.	2.20	38.	2.00
19.	2.30	39.	2.15
20.	2.30	40.	2.20
		Total	86.07
		Average	2.15

Table 76. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 12.00s
Single T.M. - 5.00
Twist per Inch in the Ply - 37.0
Ratio - .63

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.90	21.	2.20
2.	2.10	22.	2.25
3.	2.40	23.	2.10
4.	2.10	24.	1.85
5.	2.20	25.	2.45
6.	2.40	26.	2.40
7.	2.20	27.	2.00
8.	2.10	28.	2.30
9.	2.40	29.	2.10
10.	2.40	30.	2.20
11.	2.40	31.	2.40
12.	2.40	32.	2.50
13.	2.50	33.	2.40
14.	2.00	34.	2.40
15.	2.40	35.	2.20
16.	2.50	36.	2.44
17.	2.40	37.	2.20
18.	2.40	38.	2.15
19.	2.20	39.	2.35
20.	2.30	40.	1.98
		Total	90.57
		Average	2.26

Table 77. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.57s
Single T.M. - 5.00
Twist per Inch in the Ply - 44.4
Ratio - .57

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.90	21.	1.74
2.	1.90	22.	1.92
3.	1.74	23.	1.72
4.	1.94	24.	1.90
5.	1.88	25.	1.94
6.	1.72	26.	1.80
7.	1.78	27.	1.74
8.	1.80	28.	1.66
9.	2.02	29.	1.70
10.	1.78	30.	2.04
11.	1.98	31.	1.95
12.	1.90	32.	1.78
13.	1.70	33.	1.70
14.	1.94	34.	1.92
15.	1.68	35.	1.80
16.	1.80	36.	1.90
17.	1.82	37.	1.68
18.	1.90	38.	1.70
19.	1.64	39.	1.95
20.	1.70	40.	1.94
		Total	73.00
		Average	1.82

Table 78. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.10s
Single T.M. - 5.00
Twist per Inch in the Ply - 52.4
Ratio - .48

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.78	21.	1.64
2.	1.60	22.	1.45
3.	1.80	23.	1.82
4.	1.62	24.	1.42
5.	1.68	25.	1.74
6.	1.42	26.	1.80
7.	1.82	27.	1.57
8.	1.74	28.	1.74
9.	1.82	29.	1.60
10.	1.72	30.	1.60
11.	1.80	31.	1.90
12.	1.68	32.	1.42
13.	1.82	33.	1.83
14.	1.50	34.	1.82
15.	1.82	35.	1.55
16.	1.68	36.	1.68
17.	1.72	37.	1.74
18.	1.62	38.	1.60
19.	1.72	39.	1.68
20.	1.70	40.	1.72

Total 67.38

Average 1.68

Table 79. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 12.21s
Single T.M. - 5.00
Twist per Inch in the Ply - 60.4
Ratio - .41

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.40	21.	1.26
2.	1.32	22.	1.52
3.	1.55	23.	1.34
4.	1.36	24.	1.55
5.	1.50	25.	1.47
6.	1.30	26.	1.55
7.	1.34	27.	1.50
8.	1.42	28.	1.42
9.	1.54	29.	1.38
10.	1.42	30.	1.40
11.	1.26	31.	1.37
12.	1.54	32.	1.25
13.	1.50	33.	1.32
14.	1.36	34.	1.36
15.	1.48	35.	1.30
16.	1.26	36.	1.48
17.	1.46	37.	1.46
18.	1.58	38.	1.50
19.	1.32	39.	1.52
20.	1.50	40.	1.38

Total 56.74

Average 1.42

Table 80. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.60s
Single T.M. - 5.25
Twist per Inch in the Ply - 26.1
Ratio - 1.05

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.50	21.	2.55
2.	2.65	22.	2.20
3.	2.30	23.	1.95
4.	1.90	24.	1.80
5.	2.20	25.	2.30
6.	2.20	26.	2.20
7.	2.30	27.	2.25
8.	2.60	28.	1.90
9.	2.60	29.	2.40
10.	2.60	30.	2.00
11.	2.10	31.	2.40
12.	2.25	32.	2.40
13.	1.90	33.	2.10
14.	2.25	34.	1.85
15.	1.90	35.	2.50
16.	2.40	36.	2.25
17.	2.00	37.	2.25
18.	2.00	38.	2.00
19.	2.40	39.	2.40
20.	2.00	40.	1.95

Total 88.45

Average 2.21

Table 81. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.20s
Single T.M. - 5.25
Twist per Inch in the Ply - 31.4
Ratio - .88

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.92	21.	1.84
2.	2.10	22.	2.00
3.	2.04	23.	2.02
4.	1.95	24.	1.95
5.	2.10	25.	1.92
6.	1.86	26.	2.04
7.	1.90	27.	2.02
8.	2.08	28.	2.15
9.	1.95	29.	2.04
10.	1.60	30.	1.98
11.	1.98	31.	1.96
12.	1.82	32.	2.05
13.	2.08	33.	1.88
14.	2.15	34.	1.95
15.	1.96	35.	2.10
16.	1.98	36.	2.10
17.	2.02	37.	2.05
18.	2.00	38.	1.98
19.	2.05	39.	1.92
20.	1.88	40.	2.00

Total 79.37

Average 1.98

Table 82. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.54s
Single T.M. - 5.25
Twist per Inch in the Ply - 37.5
Ratio - .74

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.18	21.	2.02
2.	1.82	22.	2.16
3.	2.12	23.	1.82
4.	2.00	24.	1.94
5.	2.20	25.	1.86
6.	2.02	26.	2.02
7.	2.08	27.	2.04
8.	1.90	28.	2.04
9.	2.06	29.	2.12
10.	1.86	30.	1.90
11.	2.00	31.	1.78
12.	2.00	32.	1.84
13.	2.08	33.	2.02
14.	2.01	34.	2.15
15.	2.04	35.	2.18
16.	1.78	36.	2.00
17.	1.76	37.	2.10
18.	1.92	38.	1.97
19.	1.82	39.	2.20
20.	2.04	40.	1.92
		Total	79.77
		Average	1.99

Table 83. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.61s
Single T.M. - 5.25
Twist per Inch in the Ply - 44.0
Ratio - .62

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.90	21.	1.72
2.	2.10	22.	1.86
3.	2.05	23.	1.88
4.	1.98	24.	1.76
5.	1.76	25.	2.15
6.	2.10	26.	2.10
7.	1.86	27.	1.80
8.	2.10	28.	1.86
9.	1.72	29.	1.82
10.	1.94	30.	1.95
11.	1.74	31.	2.05
12.	1.96	32.	2.00
13.	1.75	33.	2.02
14.	2.00	34.	1.94
15.	2.02	35.	1.98
16.	1.96	36.	2.05
17.	1.96	37.	1.82
18.	1.82	38.	1.88
19.	2.01	39.	1.77
20.	1.86	40.	1.92

Total 76.92

Average 1.92

Table 84. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 12.36s
Single T.M. - 5.25
Twist per Inch in the Ply - 50.1
Ratio - .55

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.80	21.	1.55
2.	1.60	22.	1.80
3.	1.50	23.	1.74
4.	1.78	24.	1.78
5.	1.90	25.	1.66
6.	1.90	26.	1.56
7.	1.70	27.	1.85
8.	1.74	28.	1.65
9.	1.84	29.	1.50
10.	1.50	30.	1.54
11.	1.80	31.	1.80
12.	1.52	32.	1.77
13.	1.78	33.	1.60
14.	1.68	34.	1.50
15.	1.80	35.	1.74
16.	1.64	36.	1.80
17.	1.82	37.	1.75
18.	1.66	38.	1.66
19.	1.54	39.	1.50
20.	1.62	40.	1.80

Total 67.67

Average 1.69

Table 85. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.73s
Single T.M. - 5.50
Twist per Inch in the Ply - 25.3
Ratio - 1.20

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.05	21.	2.15
2.	1.90	22.	2.10
3.	2.15	23.	2.05
4.	2.08	24.	1.90
5.	2.15	25.	2.40
6.	2.05	26.	2.30
7.	2.20	27.	2.20
8.	1.80	28.	2.15
9.	2.40	29.	2.25
10.	2.00	30.	2.00
11.	2.50	31.	2.00
12.	1.90	32.	1.85
13.	2.45	33.	2.10
14.	2.50	34.	1.95
15.	2.30	35.	1.85
16.	1.90	36.	2.10
17.	1.85	37.	2.10
18.	2.30	38.	2.15
19.	2.20	39.	2.05
20.	2.05	40.	1.90
		Total	85.49
		Average	2.14

Table 86. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.78s
Single T.M. - 5.50
Twist per Inch in the Ply - 32.4
Ratio - .94

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.90	21.	1.62
2.	2.10	22.	1.80
3.	2.00	23.	1.86
4.	1.60	24.	2.02
5.	2.06	25.	2.10
6.	2.10	26.	2.15
7.	2.00	27.	2.06
8.	1.50	28.	1.94
9.	1.92	29.	1.92
10.	1.84	30.	2.00
11.	1.96	31.	1.96
12.	1.98	32.	1.82
13.	1.64	33.	2.04
14.	1.82	34.	1.98
15.	2.02	35.	1.70
16.	1.84	36.	1.80
17.	2.04	37.	2.10
18.	1.86	38.	2.05
19.	1.74	39.	1.94
20.	2.02	40.	1.80

Total 75.92

Average 1.90

Table 87. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.70s
Single T.M. - 5.50
Twist per Inch in the Ply - 37.4
Ratio - .81

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.90	21.	1.62
2.	2.02	22.	1.80
3.	1.84	23.	2.00
4.	1.84	24.	1.94
5.	1.68	25.	1.90
6.	1.74	26.	1.72
7.	1.66	27.	1.66
8.	1.74	28.	1.66
9.	2.08	29.	1.90
10.	2.02	30.	1.85
11.	1.74	31.	1.82
12.	1.66	32.	1.74
13.	1.60	33.	1.90
14.	1.64	34.	2.10
15.	1.90	35.	2.02
16.	2.02	36.	1.95
17.	1.80	37.	1.84
18.	1.82	38.	2.00
19.	1.84	39.	1.88
20.	2.05	40.	1.75
		Total	70.25
		Average	1.78

Table 88. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 15.47s
Single T.M. - 5.50
Twist per Inch in the Ply - 42.4
Ratio - .71

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.50	21.	1.54
2.	1.66	22.	1.68
3.	1.80	23.	1.76
4.	1.76	24.	1.70
5.	1.76	25.	1.75
6.	1.88	26.	1.83
7.	1.76	27.	2.02
8.	2.01	28.	1.97
9.	2.01	29.	1.86
10.	1.70	30.	1.88
11.	1.96	31.	1.70
12.	2.00	32.	1.80
13.	1.64	33.	1.75
14.	1.70	34.	1.76
15.	1.76	35.	1.94
16.	1.76	36.	1.87
17.	1.80	37.	1.58
18.	1.56	38.	1.63
19.	1.54	39.	1.72
20.	1.88	40.	1.50

Total 68.95

Average 1.72

Table 89. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 12.40s
Single T.M. - 5.50
Twist per Inch in the Ply - 48.5
Ratio - .61

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.90	21.	1.50
2.	1.72	22.	1.48
3.	1.90	23.	1.92
4.	1.76	24.	1.73
5.	2.00	25.	1.70
6.	1.70	26.	1.86
7.	1.70	27.	1.93
8.	1.74	28.	1.52
9.	1.84	29.	2.02
10.	1.86	30.	1.94
11.	1.90	31.	1.80
12.	1.80	32.	1.69
13.	1.68	33.	1.60
14.	1.94	34.	1.70
15.	1.94	35.	1.68
16.	1.50	36.	1.68
17.	1.80	37.	1.55
18.	1.94	38.	1.91
19.	1.50	39.	1.83
20.	1.66	40.	1.90
		Total	71.66
		Average	1.79

Table 90. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 12.70s
Single T.M. - 5.50
Twist per Inch in the Ply - 60.2
Ratio - .50

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.24	21.	1.32
2.	1.58	22.	1.54
3.	1.50	23.	1.40
4.	1.32	24.	1.42
5.	1.42	25.	1.36
6.	1.42	26.	1.20
7.	1.30	27.	1.18
8.	1.28	28.	1.20
9.	1.44	29.	1.33
10.	1.16	30.	1.42
11.	1.32	31.	1.37
12.	1.36	32.	1.36
13.	1.34	33.	1.44
14.	1.36	34.	1.40
15.	1.32	35.	1.54
16.	1.26	36.	1.20
17.	1.24	37.	1.55
18.	1.42	38.	1.34
19.	1.26	39.	1.42
20.	1.52	40.	1.42
		Total	54.47
		Average	1.36

Table 91. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 16.01s
Single T.M. - 5.75
Twist per Inch in the Ply - 30.0
Ratio - 1.10

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.62	21.	1.72
2.	1.80	22.	1.82
3.	1.76	23.	1.80
4.	1.64	24.	1.62
5.	1.80	25.	1.78
6.	1.82	26.	2.16
7.	2.10	27.	1.74
8.	1.76	28.	1.80
9.	1.86	29.	1.94
10.	1.84	30.	1.60
11.	1.82	31.	1.65
12.	1.86	32.	1.60
13.	1.66	33.	1.74
14.	1.90	34.	1.74
15.	1.60	35.	1.80
16.	1.60	36.	1.84
17.	1.86	37.	1.62
18.	2.02	38.	1.75
19.	1.62	39.	1.96
20.	1.72	40.	1.92

Total 71.26

Average 1.781

Table 92. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.50s
Single T.M. - 5.75
Twist per Inch in the Ply - 36.2
Ratio - .91

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.78	21.	2.10
2.	1.74	22.	1.90
3.	1.94	23.	1.92
4.	2.05	24.	2.20
5.	1.64	25.	1.62
6.	1.90	26.	2.10
7.	1.70	27.	1.92
8.	1.82	28.	2.00
9.	1.70	29.	1.82
10.	2.10	30.	1.65
11.	1.84	31.	1.58
12.	1.50	32.	1.96
13.	2.10	33.	2.10
14.	1.88	34.	2.05
15.	2.20	35.	2.05
16.	2.00	36.	2.10
17.	2.10	37.	1.90
18.	1.60	38.	1.94
19.	2.05	39.	2.15
20.	1.82	40.	1.86
		Total	76.38
		Average	1.91

Table 93. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.49s
Single T. M. - 5.75
Twist per Inch in the Ply - 44.5
Ratio - .74

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.20	21.	2.10
2.	2.45	22.	1.68
3.	2.00	23.	2.20
4.	2.20	24.	2.05
5.	1.87	25.	1.65
6.	2.05	26.	1.96
7.	1.50	27.	2.00
8.	2.00	28.	2.30
9.	2.44	29.	1.68
10.	1.60	30.	1.94
11.	1.66	31.	2.20
12.	1.95	32.	2.00
13.	2.10	33.	2.30
14.	2.14	34.	2.10
15.	2.13	35.	2.00
16.	2.10	36.	1.96
17.	2.10	37.	1.88
18.	1.95	38.	2.15
19.	2.10	39.	2.10
20.	2.02	40.	2.04
		Total	80.85
		Average	2.021

Table 94. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.41s
Single T.M. - 6.00
Twist per Inch in the Ply - 30.8
Ratio - 1.17

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.94	21.	1.92
2.	1.96	22.	2.00
3.	1.88	23.	2.02
4.	1.90	24.	2.08
5.	1.83	25.	1.96
6.	2.05	26.	1.90
7.	1.85	27.	2.10
8.	1.78	28.	2.05
9.	1.92	29.	1.84
10.	1.95	30.	1.96
11.	2.00	31.	2.02
12.	2.05	32.	1.78
13.	2.00	33.	1.80
14.	2.15	34.	1.88
15.	2.00	35.	1.96
16.	1.98	36.	1.94
17.	2.04	37.	2.08
18.	1.86	38.	2.05
19.	2.05	39.	2.00
20.	2.08	40.	1.76

Total	78.37
Average	1.96

Table 95. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.29s
Single T.M. - 6.00
Twist per Inch in the Ply - 37.1
Ratio - .97

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	2.20	21.	2.05
2.	1.94	22.	1.62
3.	1.84	23.	1.92
4.	2.15	24.	1.80
5.	1.75	25.	2.10
6.	1.80	26.	1.94
7.	1.90	27.	2.10
8.	1.80	28.	1.60
9.	1.95	29.	1.72
10.	2.10	30.	1.90
11.	1.80	31.	1.80
12.	1.90	32.	1.92
13.	1.64	33.	1.85
14.	1.64	34.	1.83
15.	1.90	35.	1.64
16.	1.95	36.	1.90
17.	1.82	37.	1.90
18.	1.82	38.	2.18
19.	1.72	39.	1.80
20.	1.82	40.	1.95

Total 74.71

Average 1.86

Table 96. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 13.77s
Single T.M. - 6.00
Twist per Inch in the Ply - 43.2
Ratio - .84

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.42	21.	1.70
2.	1.54	22.	1.44
3.	1.62	23.	1.42
4.	1.58	24.	1.56
5.	1.78	25.	1.76
6.	1.56	26.	1.92
7.	1.50	27.	1.77
8.	1.75	28.	1.52
9.	1.56	29.	1.76
10.	1.70	30.	1.48
11.	1.58	31.	1.90
12.	1.42	32.	1.75
13.	1.78	33.	1.55
14.	1.90	34.	1.92
15.	1.54	35.	1.94
16.	1.94	36.	1.56
17.	1.64	37.	1.64
18.	1.80	38.	1.72
19.	1.40	39.	1.70
20.	1.64	40.	1.85

Total 66.51

Average 1.66

Table 97. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 14.67s
Single T.M. - 6.00
Twist per Inch in the Ply - 48.8
Ratio - .74

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	1.50	21.	1.35
2.	1.66	22.	1.42
3.	1.44	23.	1.44
4.	1.64	24.	1.63
5.	1.44	25.	1.70
6.	1.42	26.	1.48
7.	1.66	27.	1.36
8.	1.80	28.	1.66
9.	1.42	29.	1.42
10.	1.50	30.	1.62
11.	1.70	31.	1.48
12.	1.66	32.	1.50
13.	1.50	33.	1.65
14.	1.36	34.	1.32
15.	1.62	35.	1.70
16.	1.74	36.	1.50
17.	1.62	37.	1.44
18.	1.50	38.	1.52
19.	1.30	39.	1.60
20.	1.60	40.	1.68

Total 61.55

Average 1.54

Table 98. Cotton 30/2 Yarn Single Strand Breaking Strengths.

Count - 11.47s
Single T.M. - 6.00
Twist per Inch in the Ply - 62.0
Ratio - .58

Specimen Number	Breaking Strength Pounds	Specimen Number	Breaking Strength Pounds
1.	.98	21.	.96
2.	1.10	22.	1.20
3.	1.34	23.	1.34
4.	1.20	24.	1.08
5.	1.08	25.	1.25
6.	1.28	26.	1.32
7.	1.24	27.	.95
8.	.98	28.	1.10
9.	1.14	29.	1.20
10.	1.22	30.	1.24
11.	1.34	31.	1.15
12.	1.02	32.	1.30
13.	1.12	33.	1.24
14.	1.16	34.	1.20
15.	1.36	35.	1.36
16.	1.20	36.	1.16
17.	1.40	37.	1.10
18.	1.36	38.	.96
19.	1.34	39.	1.36
20.	1.32	40.	1.20

Total 47.85

Average 1.20

Table 99. Nylon Single Strand Breaking Strengths for 30s Staple Yarn.

Single Twist Multiple	Breaking Strength Pounds
2.50	.96
2.75	1.00
3.00	1.03
3.25	.99
3.50	1.03
3.75	1.01
4.00	1.09
4.25	1.09
4.50	.98
4.75	1.00
5.00	.99
5.25	.99
5.50	.97

Table 100. Cotton Single Strand Breaking Strengths for 30s Yarn.

Single Twist Multiple	Breaking Strength Pounds
2.50	.60
2.75	.75
3.00	.81
3.25	.83
3.50	.88
3.75	.88
4.00	.95
4.25	.93
4.50	.96
4.75	.98
5.00	.94
5.25	.95
5.50	.96
5.75	.94
6.00	.90

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